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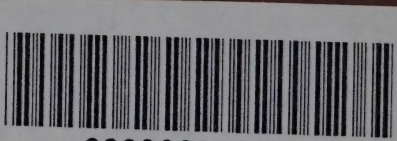

S. Lowell Macfarlane
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LECTURES

General Hospl
25th Nov: 1869

ON

PUBLIC HEALTH,

DELIVERED AT THE ROYAL COLLEGE OF SURGEONS,

By E. D. MAPOTHER, M.D.,

PROFESSOR OF HYGIENE,

HONORARY MEMBER METROPOLITAN ASSOCIATION OF MEDICAL OFFICERS OF HEALTH: MEMBER OF COUNCIL OF SURGICAL AND OF STATISTICAL SOCIETIES; MEDICAL OFFICER OF HEALTH, CITY OF DUBLIN; SURGEON TO ST. VINCENT'S HOSPITAL.

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THE

Royal College of Surgeons in Ireland,

IN 1844,

PROCLAIMED THE IMPORTANCE OF SANITARY INSTRUCTION BY FOUNDING A CHAIR OF HYGIENE.

TO THE FELLOWS OF THAT BODY,

THEREFORE,

WHOSE ABILITY, DISINTERESTEDNESS, AND SOCIAL STANDING, HAVE MUCH INFLUENCED LEGISLATIVE MEASURES FOR THE PRESERVATION OF PUBLIC HEALTH,

These Lectures are Dedicated

BY THEIR GRATEFUL SERVANT,

THE AUTHOR.

PREFACE.

In publishing the first course of these Lectures, I was obliged to excuse many shortcomings by acknowledging that they had been hurriedly prepared. I must now put in a similar plea, for just as I had begun to prepare for press last November, I was called on to take temporary charge of the Chair of Physiology; and although chemistry and the microscope afforded the principal sources of instruction for this subject as well as Hygiene, additional time was needed for the arrangement of appliances.

However, as some interest would attach to an account of the Cholera Outbreak, and to Sanitary Statistics in view of improved legislation during the approaching Session, I was unwilling to postpone publication to a time of greater leisure.

The first Lecture, having been scarcely altered, exhibits the status of disease in Dublin in 1864; the

others included in the first edition have been enlarged, and twelve new ones have been added.

Throughout all of them my aim has been to awaken an interest in the study of the healthy functions of the human body, as I believe that it is only by the spread of such knowledge that quackery will wane, and that sanitary reforms will rest on a safe, because reasonable, foundation.

E. D. M.

1*st February*, 1867.

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ERRATA.

Insert Hardwicke *in line* 16, *page* 489.
„ not „ 15, „ 588.
For Barkers *read* Baker, *line* 1, „ 594.

LECTURES

ON

PUBLIC HEALTH.

INTRODUCTORY.—EPIDEMICS OF THE MIDDLE AGES.—RECENT EPIDEMICS.—SANITARY STATE OF DUBLIN IN 1864.

Mr. President, my Lord, and Gentlemen—The natural pride which I derive from the honorable, but, I fear, too difficult post which you have elected me to, is mingled with a feeling of admiration for the far-seeing wisdom of the governing body of this College, who, in 1844, founded this Chair, and thus anticipated the institution of any similar means for diffusing amongst the community at large a knowledge of those laws by which health may be preserved and disease diminished. Since that period, in many Continental and a few British schools, professorships of this subject have been founded under the various titles of "Preventive Medicine," "Public Health," "Hygiene," and similar designations; and the directors of army medical education, both at home and abroad, have signalized themselves by the importance they have attached to it. In the great school recently created at Netley Hospital there are combined, under the able direction of Prof. Parkes, the most perfect appliances for teaching hygiene hitherto realized.

This science, as I understand it, is an application of the laws of physiology and general pathology to the maintenance of the health and life of communities, by means of those agencies which are in common and con-

stant use. It is, therefore, a department which the medical profession can share advantageously with the public, who, indeed, through the medium of Social Science Associations, Parliamentary Commissions, and similar organs of inquiry, are advancing rapidly in sanitary knowledge. Opportunities for enforcing its teachings lie within the power of every individual, and especially of local municipal authorities, who undertake the onerous duty of caring for the domestic and public wants of their fellow-citizens. Although, in all times, attention was paid by physicians to the prevention of disease, it is only within a very recent period that public attention has been attracted to sanitary inquiries. In civil life an interest was especially awakened by the reports on the health of towns by Edwin Chadwick, in 1846; and in military life the subject forced itself on the authorities in a still more painful manner—by the lamentable loss of life among our brave soldiers during the Crimean campaign, which was afterwards proved to have been avoidable in a great degree. It was proved that nothing is more costly than disease, and that the outlay which increases health and strength amply repays. The employer often finds that by due sanitary care of his workmen, he at once gains by better work and greater assiduity, as well as by fewer interruptions from sickness. Prof. Parkes likewise shows that this is an obligation in the case of the army, for the state removes from the soldier the self-control with regard to hygienic rules which other men possess; and it is therefore bound, by every principle of fair contract, to take care that he shall not be injured in any way by its system. "It was the moral argument, as well as the financial one, which led Lord Herbert to devote his life to the task of doing justice to the soldier—of increasing the amount of his health, and moral and mental training, and in so doing of augmenting not only his happiness, but the value of his services to the country. And by the side of Lord

Herbert in this work was one whose name will ever be dear to the country, and whose life, ever since that memorable winter at Scutari, in 1855, has been given up entirely to the attempt to improve the condition of the soldier"—the glorious Florence Nightingale.

The audience which I will have the honour to address in this and succeeding lectures being composed of both lay and professional persons, I feel the peculiar difficulties which arise from such a circumstance, for I fear that in endeavouring to elucidate many facts unfamiliar to the former, I shall be reciting what my medical brethren must regard as obvious corollaries from data already in their possession. It seems to me that I shall most readily secure your attention upon the present occasion, and convince the sceptical, if such there be, of the importance of sanitary instruction and organization among the general public, by sketching, though very briefly, the evils which, both in ancient and modern times, have ensued from neglect of all wholesome precautions, and the benefits which a diffusion of sanitary knowledge has conferred on mankind.

Those of the Mosaic laws which regard bodily health are of the fullest and most positive character, and to people living under similar climatic conditions none more appropriate could be devised at the present day. In this divinely-instituted system, hygienic observances are incorporated with the religious code. Many of the teachings of the Koran also, respecting ablutions and other means of personal cleanliness, are worthy of our best attention; while the sanitary knowledge of heathen Rome is attested by the stupendous aqueducts and sewers, whose very ruins at present excite our admiration.

A lamentable falling off in the regard paid to public health is observable in the towns and cities of mediæval Europe. Crowded within a narrow compass, hemmed in by high walls, all sanitary laws neglected in the unsettled and disorganized condition of society then ex-

isting, the masses were decimated by constantly recurring plagues, fevers, and famines. Prof. Parkes says: "Whoever considers carefully the record of the mediæval epidemics, and seeks to interpret them by our present knowledge of the causes of disease, will, I believe, become convinced that one great reason why those epidemics were so frequent and so fatal, was the compression of the population in faulty habitations. Ill-contrived and closely-packed houses, with narrow streets, often made winding for the purpose of defence; a very poor supply of water, and therefore an universal uncleanliness; a want of all appliances for the removal of excreta; a population of rude, careless, and gross habits, living often on innutritious food, and frequently exposed to famine from their imperfect system of tillage—such were the conditions which almost throughout the whole of Europe enabled diseases to attain a range, and to display a virulence, of which we have now scarcely a conception. The more these matters are examined, the more, I believe, shall we be convinced that we must look, not to grand cosmical conditions, not to earthquakes, comets, or mysterious waves of an unseen and poisonous air—not to recondite epidemic constitutions, but to simple, familiar, and household conditions to explain the spread and fatality of the mediæval plagues."

The plague popularly known as the "Black Death," which travelled over the Old World, from China even to Greenland, during the five years from 1345 to 1350, and carried off at least one-fourth of its population, is now well known to have been due to over-crowding and want of cleanliness, and was preventible by their removal and by quarantine. This pest had always had its starting point and permanent habitat in Egypt, where the Arab, his wives, children, servants, and domestic animals exist huddled together in a state which the distinguished observer Clot Bey describes in the words, "unheard-of filth reigns in their infected haunts." Their strength is

destroyed by their precarious supply of food, which they cook over fires made with dried manure. In China 13,000,000 perished, and thousands fell victims to this scourge of the fourteenth century in every town in Europe. In Venice 100,000 died, and in Paris the number of deaths was at least 50,000; and it is also recorded that "in many places in France not more than two out of twenty of the inhabitants were left alive, and the capital felt the fury of the plague alike in the palace and the cot. Two queens, one bishop, and great numbers of other distinguished persons fell a sacrifice to it, and more than 500 a-day died in the Hôtel Dieu under the faithful care of the Sisters of Charity, whose disinterested courage in this age of horror displayed the most beautiful traits of human virtue. For although they lost their lives evidently from contagion, and their numbers were several times renewed, there was still no want of fresh candidates, who, strangers to the un-Christian fear of death, piously devoted themselves to their holy calling."

The College of Physicians of Paris issued a remarkable manifesto, in which they endeavoured to prove an astral origin for the plague; but their advice with regard to water and food is not to be despised. It is a remarkable circumstance, which is recorded by all writers on the subject, that the fecundity of females was much increased after this dire destruction of human life. That fearful affliction of the middle of the 16th century, the sweating sickness, appeared to partake of the characters of ague and of rheumatic fever. It began in England, and never extended to this country, although multitudes of the affrighted people flocked hither. It frequently caused death in twenty-four hours; and although it remained but a few days in each town, one-fourth of the inhabitants often perished. Recoveries were numerous when the patient was let alone, or treated by a cooling regimen in an airy room. In Germany, the death of those

attacked at first was certain, although not surprising when we reflect upon the following mode of treatment: "They put the patients, whether they had the sweating sickness or not (for who had calmness enough to distinguish it ?), instantly to bed, covered them with feather-beds and furs, and whilst the stove was heated to the utmost, closed the doors and windows with the greatest care to prevent all access of cool air. In order, moreover, to prevent the sufferer, should he be somewhat impatient, from throwing off his hot load, some persons in health likewise lay upon him, and thus oppressed him to such a degree, that he could neither stir hand nor foot; and finally, in this rehearsal of hell, being bathed in an agonizing sweat, he sank exhausted."

The plague which produced over 100,000 deaths in London in 1665, and of which we cannot read in the graphic pages of De Foe after such a lapse of time without the strongest feelings of awe and pity, was the last epidemic of its kind which visited western Europe. Many outbreaks of it, however, have occurred since then in the East, and during the late war a malignant fever arose at Odessa, which, but for the prudence of the Russian government, desirous to check alarm, should have received its true name—"the plague." As an example of a severe epidemic resulting from neglect of sanitary precaution, I shall allude to the Russian epidemic of 1864, as it is of such recent occurrence and excited such interest. As you are aware, it was at first named "the plague," and believed to be similar to that pest which has a constant habitat in Egypt, and which occasionally breaks out in the eastern lands; but it was afterwards shown, by the investigations of St. Petersburgh physicians, and of a Commission sent by the English Privy Council, to be but a very prevalent and fatal epidemic of typhus fever and of relapsing fever. The former was evidently due to the filthy and over-crowded state of the dwellings of the labouring class, which, be-

cause of the coldness of the weather, are kept horribly close; and the latter to a scarcity of food which at the same time afflicted them. This famine-fever having been previously unknown in Russia, created the greatest and most universal alarm. In this country the disease is but too well known.

Another epidemic of an entirely different kind prevailed in northern Germany, along the Vistula, in the winter of 1864 and following spring; and, strange enough, we have had experience of it also in Ireland. During the famine years, especially 1847, the younger inmates of the Bray and South Dublin Union were attacked in considerable numbers by a peculiar and fatal nervous disease, which was fully described by Dr. Darby and by the late lamented Dr. Mayne. It was characterised by the most extreme stiffness of all the muscles, similar to what occurs in lockjaw, and by such increased sensitiveness of the skin that the slightest touch or draught of air produced intense agony. It was induced by the preceding scarcity of food, and was not communicable from one person to another. It has since been observed in America, and, as I have said, recently broke out in northern Germany. I lately had the advantage of conversing with Dr. Sanderson, the physician sent by the English government to study the epidemic, and it appears to have agreed closely with the malady which invaded us. You will have perceived, then, that a great deal of alarm was extensively created about these epidemics, and the English Privy Council deemed it necessary to issue full instructions to the authorities of seaport towns, in case ships from these infected countries should arrive.

Scarcely inferior in virulence, and more disastrous in the prolonged illness which it produces, is the epidemic fever which at closely recurring intervals has depopulated our poor land. I shall mention a few of the most remarkable of these epidemics, the more especially as

they convincingly show the very principal dependence of fever upon an insufficiency of food—an evil, I trust, we may consider, at least to a great degree, preventible—and not on climatic conditions beyond our control. 1729—Most severe epidemic, great distress, and want of food; weather not remarkable. 1740—Dearth of provisions almost amounting to famine; weather favourable; 80,000 died, or, according to another authority, Dr. Rutty, one-fifth of the population. 1817-18—Corn saved was green in the husks; potatoes scanty, wet, unripe. One million and a-half of cases occurred in this epidemic. Early in 1846, just when great anxiety was being felt for the safety of the potato crop, Sir D. Corrigan published his famous pamphlet, urging the dependence of fever upon scarcity of food, and advising that all available precautions should be adopted. His anticipations were, as most of my hearers remember, awfully realized, for in the three terrible years following 579,721 cases were treated in the hospitals alone. The disease usually known as the "ship-fever," which followed, destroyed thousands of the wretched emigrants—scarcely a vessel escaped; and to show its malignity, I may mention that in one, the *Loosthank*, 329 out of 349 passengers caught the contagion, and of these 117 died. The influx of destitute and fever-stricken Irishmen into many British towns spread widely the contagion, and that into Liverpool was so enormous, that the death-rate of the town was raised to 70 per 1,000, more than double its average, being the highest mortality ever recorded in any modern city—so that it well deserved the name of the "hospital and cemetery of Ireland."

As regards the prevention of typhoid or intestinal fever, what can we hope for? I will answer in three sentences from the most recent and very highest authorities: "Every year in England more than 100,000 human intestines, diseased in the way already described, continue each for the space of a fortnight or thereabouts

to discharge upon the ground floods of liquid charged with matters on which the specific poison of a communicable disease has set its most specific mark." "By subjecting the discharges on their issue from the body to the action of powerful decomposing chemical agents, they may be entirely destroyed. Typhoid fever ought, therefore, soon to disappear from every return of disease, whether in military or civil life." "The grand fact is clear, that the occurrence of typhoid fever points unequivocally to defective removal of excreta, and that it is a disease altogether and easily preventible." I will not add a word of comment upon these deliberate opinions of three of the most scientific physicians living.

When typhus, the other variety of Ireland's epidemic enemy, is most indubitably spread by over-crowding, want of ventilation, miasmatous pools and dung-heaps at the very doors, bodily filth, and deficient food, may we not hope it is equally remediable? There is little doubt that the susceptibility to epidemics, and the great mortality they have produced in our land, were due to the miserable and squalid state of our down-trodden peasantry, subsisting, just at the verge of civilization, upon the potato.

How have Irish physicians acted when pestilence is prostrating their fellow-men, and depopulating their beloved country? Most nobly; and their conduct, as set forth in Drs. Cusack and Stokes' well-known paper, "On the Mortality of Medical Practitioners in Ireland," cannot be too often held up for admiration and imitation, although it is to be hoped that improved sanitary measures will never allow the recurrence of so costly and unnecessary a sacrifice. There had been attacked with fever during the years from 1819 to 1843, 560, or nearly one-half of the physicians of public institutions, and nearly 45 per cent. of the deaths amongst them were due to this contagious disease. In 1847, 123, or two-thirds of the entire deaths of medical practitioners,

were due to fever; or, in other terms, 40 out of every 1,000 living—being a proportion of more than forty times as great as the Registrar-General's returns show for the English population. Many British towns, receiving our afflicted countrymen with the seeds of typhus upon them, suffered fearfully from the epidemic of 1847; and the labours of one Edinburgh physician, Dr. Gairdner, now Medical Officer of Health for Glasgow, are worthy of record. The infirmary was so overcrowded that it contained twenty times its usual number of cases, and became a huge focus of contagion, and to serve in it was certain infection to doctor or nurse. Additional wards were improvised out of two garrets—mattresses and blankets being placed on the floor. One night at ten o'clock, after the harassing duties of the day, Dr. Gairdner had to see over one hundred new patients in these rooms, through which he could not walk without stooping, and in which it was necessary to kneel or sit upon the floor to examine the pulse or tongue of each patient. Of twenty-two resident physicians, twelve took the fever, three having had it before; of nine attending physicians, six had previously the disease, and the three remaining now contracted it. The ranks of these officers lost four by death, and "paid this heavy tribute of the medical profession to the unduly severe pressure thrown on them by the carelessness of the community in not anticipating and providing for the approach of disease." Such services, though they may not equal the brilliancy of military heroism, surpass it in usefulness, and should meet with adequate public recognition.

As a painfully striking instance of the evils of ignorance among students of my own profession, of the danger of infection carried from the dead body to females in the puerperal state, I may tell you that from 400 to 500 deaths in the Lying-in Hospital of Vienna were annually traced to this cause; and so little attention is

practically bestowed upon a free supply of pure air in these days, which in our vanity we call "enlightened," and in places upon which one would have thought official wisdom was concentrated, that the Commissioners who, five years ago, investigated the cubic space and ventilation of the barracks throughout our country, found that nearly half our soldiers were living in but 400 cubic feet of space each—a condition under which it was impossible for robust health to be maintained, and that some were condemned to almost certain death by having less than 250 feet. It has been indeed truthfully said, that "the saddest pages in the history of all nations are those which treat of the wholesale sacrifice of human life, through ignorance or neglect of the simplest means of preserving health or averting disease," and I am afraid we must acknowledge that our art has scarcely preserved an equal number of human beings.

A most gratifying example of the benefits of sanitary reform and scientific construction of dietaries is afforded by scurvy—a disease which some years ago destroyed more of our sailors than every other sickness, the casualties of the ocean, and the efforts of our enemies all combined. Sir Richard Hawkins tells us he himself knew over 10,000 mariners to have died of scurvy within twenty years, and it likewise renders other diseases more frequent and fatal by its debilitating effects. By the use of lemon-juice, which Sir Gilbert Blane discovered to be powerfully preventive, fresh animal food, and proper ventilation, no such disease now ever appears—except, indeed, where ignorance of these measures, or greed of gain by adulteration, substitutes other acids for the lemon-juice. Thus on board our transport ship *Tasmania*, scurvy raged among our Indian soldiers returning home in 1860, mainly because sulphuric acid had been, with murderous dishonesty, substituted for lime-juice.

In America, unsanitary influences are so rife, that one

of the rarest things to be seen is a hale elderly man, and Dr. Nicholl, in his recent most able and interesting work, "Forty Years in America," confesses to a degeneracy of the Anglo-Saxon type among his countrymen, and attributes it to their unwholesome food, and, on the part of the females, to injurious habits in respect to clothing and domestic arrangements.

The legislature have done their duty respecting sanitary measures in such establishments as prisons, barracks, and hospitals, which are wholly under official inspection, and disease and mortality have been immensely reduced. I trust on future occasions, by data afforded by the system of vital statistics now inaugurated in this country—for its returns I shall make my text—to interest you with Irish facts and figures exhibiting improvement; but now I must content myself with the following instance of the superior health and more efficiently checked disease among the inmates of Salford prison than among the neighbouring factory operatives. The former suffer but half as many days of sickness as the latter; and an attack of diarrhœa among the prisoners, produced by the bursting of a sewer, was checked without a single death occurring as soon as the cause was ascertained; whereas 248 deaths from this disease, produced by very similar causes, were recorded in 1856 in the same district.

The sanitary measures which it will be the business of these lectures to more fully illustrate, may be enforced by the Nuisances Removal Acts, and a few others amalgamated with the Public Health Act of 1866. It is to be regretted that, in this department of legislation, every good sanitary statute does not apply to Ireland as well as to our more favoured sister island, and that all their provisions are not consolidated into one act of easy reference. Those admirable enactments, the Local Government Act, 1858, and the Public Health Acts, 1848 and 1858, introduced by our late honoured Viceroy, then Lord Morpeth, do not extend their benefits to Ireland.

Their regulations apply to towns in their ordinary status of health, but they should be carried on with increased vigour on the threatening or visitation of any epidemic.

I acknowledge that there is some difficulty in statistically demonstrating the permanent reduction of deaths which have accrued from the sanitary labours of medical officers of health; but all will grant that they have had their share in reducing the death-rate of London generally from about 26 to 23 per 1,000, and of some parts of it to a lower rate than that of the most salubrious rural districts; and in the words of the Registrar-General, "If the mortality of London were confined permanently within the limit represented by the mean rate of the last three years (1859, 1860, 1861), the effect of that reduction in the population, as it exists at present, would be that more than 4,000 persons would survive annually, whose lives would drop under the mean rate derived from the twenty years 1840-59; and if the measures that have been already adopted are not relaxed, the amount of benefit will be increased as the population that is the subject of it is increased."

But so far from regarding the improvements which sanitary science has already accomplished as having attained so high a perfection as these remarks seem to imply, I feel that they are as yet merely initiatory movements. Many lives are lost from casualties in many cases beyond the control of human foresight, as, for instance, shipwreck, by which 1,500 of the picked men of the people annually perish on our coasts, or are destroyed by such appalling calamities as the recent conflagration of the Santiago chapel. All of these deaths justly excite the sympathy of the public. Will not, therefore, the most strenuous efforts be made to check preventible deaths, scores of times more numerous, because they occur in a less sudden and perhaps less appalling manner?

Some years since the salubrity of the country, as in-

dicated by the average age and the death-rate, was very much greater than that of towns; for instance, the average duration of life among the labouring population of Wiltshire was 33, while it was but 17 in the manufacturing town Manchester; but in 1863 the death-rates of urban and rural districts were very nearly equal: thus, in St. Giles', London, but 13·6 died out of each 1,000 living, and but 17 in the Cavendish sub-division of the Marylebone district—a proportion the same as in Glendale, Northumberland, and the Isle of Wight, which have been reckoned the most healthful places in Britain. But no town surpasses Liverpool in the evidence it affords of benefits resulting from sanitary precautions. In 1842, one-third of its labouring population lived in cellars about twelve feet square, sometimes less than six feet high, often without windows, and only lighted and ventilated by a door frequently below the level of the street. Its death-rate was 38 in 1846; but up to 1864, owing to the philanthropic labours of the late Dr. Duncan and his most able successor, in carrying out improved sewerage, closing of cellars, preventing overcrowding, especially in the low lodging houses, and separating contagious cases, it had been reduced to 24, or less than two-thirds its former rate, and thus it may be estimated from the population of that city that 4,000 lives have been annually saved. During the past two years, the fearful mortality by fever and cholera indicate that insalubrious agents are still most potent in that vast and changing population.

The Registrar-General's returns show that one-half the deaths of England, and nearly two-thirds of those in ill-regulated towns, occur from diseases which are either wholly or partially preventible, such as typhoid fever, diarrhœal complaints, pulmonary diseases, nervous affections of infants, and the contagious fevers of children. Besides these 50,000 deaths, at least twenty attacks of illness will correspond to each of them, and

this gives annually 1,000,000 cases which the hygienist may strive to prevent.

Most of these deaths are premature—not removing the old and enfeebled, who should have shortly succumbed under any circumstances, but striking down the hale of both sexes, who are productive members of society, and whose loss throws a number of orphans and aged people as a burthen on the public. Fever is one of the most powerfully pauperizing agencies, being especially apt to remove those of the middle, or most valuable period of life. Thus, of 2,537 cases of fever collected some years ago by Dr. Southwood Smith, 68 per cent. were between twenty and forty years of age, but 17 per cent. below that period, and 15 per cent. above it. Widows and orphans are thus plunged from independence into pauperism, which, as they become habituated to idle dependence, is rarely recovered from ; and it has been found that even when the children, having grown up, leave the poorhouse and marry, their habits are improvident, and they frequently relapse into the conditions under which they were reared. Such premature deaths must in this country, above all others, be most severely felt, by adding to taxes which are already at least sufficiently high—and still worse, by thinning the labourers for agricultural or manufacturing enterprise, they must help to further defer our long hoped-for prosperity.

Among the evils attributed to the condensing of population within towns, which is a striking feature of modern days, I will, on the present occasion, allude to but one. Consumption and allied diseases slay about 100,000 yearly in England, Ireland and Scotland, and these deaths are distributed in almost exact proportion to the density of the population. This pernicious effect of the varied evils of over-crowding, I can best illustrate by some figures referring to three divisions of London :

RELATION OF DENSITY OF POPULATION TO MORTALITY FROM LUNG DISEASE.

Three London Divisions.	Deaths annually out of 100,000 living.	
Square yards to each person.	Consumption.	Other pulmonary diseases.
180	375	659
119	405	771
35	485	914

It has been often inferred, from misinterpretation of the views of an eminent statist, that mortality is in direct proportion to the simple density of population; but this observation is a proof of how fallacious statistics may become if handled unphilosophically. Density of population is very commonly accompanied by impure air, scanty water, insufficient drainage, and such concurrent evils which may exist and produce the worst effects amidst a sparse population. Condensation of inhabitants, on the other hand, so far from being lamented as an evil, seems a necessity of modern civilization, and to such condensation most of its triumphs are due; but at the same time it devolves on the authorities, and especially upon those whose wealth is amassed by the toil of the poor, to see that it shall be stript, as far as possible, of evils not necessarily concomitant.

Of successful efforts, under these circumstances, to preserve the health of towns, I cannot give you a more forcible example than those of the Macclesfield Board of Health, cited by Lord Shaftesbury. When they began their labours the death-rate was 33—for the last five years it has been but 26; so that counting the population as stationary, 1,015 lives have been saved; 28,420 less cases of sickness have occurred; three years have been added to the average duration of life; the morta-

lity of children under one year has decreased 16 per cent.; and, lastly, there have been 27 per cent. less zymotic diseases.

I will next illustrate the advantages to be derived from health inspection during the outbreak of an epidemic. Small-pox prevailed epidemically in London during the earlier months of 1860, and in order to make vaccination as general as possible, examination of all young persons was determined on, and the zeal with which it was carried out is recorded in the official report to the Privy Council. "The extent to which this examination was carried varied in the different unions; but it was carried to a large extent in all of them, and in the great majority was effected in a very complete manner indeed by the medical officers of health, with a zeal and assiduity of which I cannot too highly express my admiration. Forty thousand children were examined in a very short space of time. Infected localities were also visited by the health officers, often house after house, and every adult and child was examined as to their protection." The results of this labour will best appear in the following figures:—The deaths by small-pox at the patients' homes were, in January, 129; February, 136; March, 144; but in April and May, when the preventive measures might be fairly expected to tell, the deaths were but 78 and 57, and chiefly occurred amongst the unvaccinated. When giving an account, in a future lecture of the recent epidemic of cholera, many more striking instances will come before us.

Sanitary organization, however, will always be incomplete and very generally inoperative without the aid of the popular educator—for a thorough system of inspection of the circumstances prejudicial to health in individual cases will be always resented by those who do not understand the advantages accruing, and the appropriate maxim of our city, *obedientia civium, urbis felicitas*, will not be realized. The teachings of hygiene do good, not

only by suggesting rules for individual management, but also by preparing the popular mind for measures of sanitary reform, the proposal of which among the ignorant or parsimonious often meets with apathy, or still further, opposition. With regard to the effect of external agencies on the health of our bodies, ignorance and desperate negligence prevails even amongst the most refined classes. I know I am making a most trite remark when I say, that the humblest in the land for whom state education is provided should be taught something of the structure and functions of the human body, and the means for preserving it in health, and I only do so because the subject has never formed portion of the knowledge imparted in our schools. Very recently in the universities the matter has received some attention. In America I find they have been in this particular in advance of us, for in some of the States there are special enactments requiring physiology and hygiene to be taught in the public schools. Prof. Parkes exclaims: "Were the laws of health and physiology better understood, how great would be the effect! Let us hope that matters of such great moment may not always be considered of less importance than the languages of extinct nations, or the unimportant facts of a dead history."

As an anatomical lesson for my medical hearers, and an eloquent tribute to the wonders of human construction, let me quote from Dr. Holmes, the first of American *litterateurs*,

"AN ANATOMIST'S HYMN—THE LIVING TEMPLE.

"Not in the world of light alone,
Where God has built His blazing throne,
Nor yet alone in earth below,
With belted seas that come and go,
And endless isles of sunlit green,
Is all thy Maker's glory seen—
Look in upon thy wondrous frame,
Eternal wisdom still the same!

"The smooth, soft air with pulse-like waves
Flows murmuring through its hidden caves,
Whose streams of brightening purple rush,
Fired with a new and livelier blush;
While all their burthen of decay
The ebbing current steals away,
And red with Nature's flame they start
From the warm fountains of the heart.

"No rest that throbbing slave may ask,
For ever quivering o'er his task,
While far and wide a crimson jet
Leaps forth to fill the woven net,
Which in unnumber'd crossing tides
The flood of burning life divides,
Then, kindling each decaying part,
Creeps back to find the throbbing heart.

"But warm'd with that unchanging flame,
Behold the outward moving frame,
Its living marbles jointed strong,
With glistening band and silvery thong,
And link'd to reason's guiding reins
By myriad rings in trembling chains,
Each graven with the threaded zone
Which claims it as the Master's own.

"See how yon beam of seeming white
Is braided out of seven-hued light,
Yet in those lucid globes no ray
By any chance shall break astray.
Hark, how the rolling surge of sound,
Arches and spirals circling round,
Wakes the hush'd spirit through thine ear
With music it is heaven to hear.

"Then mark the cloven sphere that holds
All thoughts in its mysterious folds,
That feels sensation's faintest thrill,
And flashes forth the sovereign will;
Think on the stormy world that dwells
Lock'd in its dim and clustering cells;
The lightning gleams of power it sheds
Along its hollow glassy threads!

"O Father! grant Thy love divine,
To make these mystic temples Thine,
When wasting age and wearying strife
Have sapp'd the leaning walls of life;
When darkness gathers over all,
And the last tottering pillars fall,
Take the poor dust Thy mercy warms,
And mould it into heavenly forms."

During the few remaining minutes of this hour's lecture, I will invite your attention to the present sanitary state of Dublin, as far as it can be displayed by a system of death-registration but six months old, and a Medical Officer of Health but a fortnight in office. The first half-yearly report of the Registrar-General will be published to-morrow, but through his kindness I may anticipate it with one fact. During the twenty-six weeks ending 2nd July, 1864, there were 3,414 deaths registered within the municipal boundary, and this, calculating on the ratio of the first half of the year, would give a death-rate of about 27 for every 1,000 living.

I trust the time will come when sanitary statistics will be taken on so philosophical a scheme as to bring home to the mind of the most indifferent or selfish the chances of health or life in every class of street. For the three years, 1839, 1840, 1841, the death-rate was estimated at 30, and but 17 in the surrounding country; and considering the absence of many manufactures which prejudice the health of English towns, though they enrich them, the impression that mortality is high in Dublin has been very general, and is constantly expressed in the writings of great medical authorities of former days. Short (1750) asserts, "that sickly years are more fatal in Dublin than in London." Rutty (1772) remarks, "that those who know the situation of the poor here can be at no great loss to account for the frequency and mortality, especially of fevers, several families being in one room, which must undoubtedly contribute not only to the propagation, but also to the malignity of these diseases."

The status of disease in Dublin is shown by the medical tables of the last census, so admirably arranged by Sir William Wilde, for in a population of 254,293 persons, 5,646 "laboured under temporary or permanent disease on the night of the 7th April, 1861," and of these, 1,763, or over one-third, were ill of diseases which were plainly preventible, or to be much diminished by attention to sanitary conditions, such as fevers, scrofula, consumption, dyspepsia, rheumatism, debility, &c.

It has been calculated that out of 100 children of the labouring classes born in Dublin, but 34 live to be 20, 20 to be 40, and only 14 to be 50. These figures applied to the present male population of the city, indicate that about 20,000 men will die between the ages of 20 and 40, and 10,000 between 40 and 50. Such premature deaths cannot be attributed to want of provision of curative medicine—for in no city in the empire are there more skilful and zealous physicians for the poor—but must, in a great proportion of instances, be assigned to ignorance of, or inattention to, the teachings of preventive medicine. Over-crowding, impure air, insufficient water, imperfect sewerage, debility, pauperism, contagious scourges, death, widowhood, orphanage, and high taxation, have been, then, in this city sequential terms.

In 1844, the death-rate of children under five years of age was estimated to be 40 per cent., and so very great a mortality is a test of their being some most insalubrious agencies at work, such as impure air, confined space for exercise, want of breast-nursing, and scanty supply of cow's milk. Such causes, and those influences connected with a city life which induce an early puberty and arrest of growth, have set their mark on the children of the labouring class in the more crowded parts of Dublin, who are remarkable for stunted proportions and scrofulous, precocious aspect—characters which will be

intensified in future generations, if the causes which produced them be not corrected.

The density of the population and the over-crowding of some of the poorer districts of our city are shown in the following tables :

DENSITY OF POPULATION.

Census 1861.

	Population.	Houses.	Average to each house.	Acreage.	Average to each acre.
Dublin City ..	254808	23001	11	3592	71
St. Michan's ..	20085	1417	14	122	165
St. Nicholas' ..	11322	922	12·3	58	195

POORER DISTRICTS.

Streets and Alleys.	Houses.	Rooms.	Beds and Straw.	Inhabitants.	Average to each room.	Average to each bed.
134	2102	11214	14850	40319	3·59	2·71

The second table I give on the authority of Mr. Nugent Robinson, the Secretary of one of the Committees of the Corporation.

Instances of much greater over-crowding I could very easily adduce from my own experience, but I prefer to offer you the evidence of others. The following extract from Dr. Willis's essay "On the Sanitary State of Dublin" is striking and, after twenty years, still true, as I have had lately many opportunities of knowing : "In some rooms in these situations it is not an unfrequent occurrence to see above a dozen human beings crowded into a space not fifteen feet square. Within this space the food of the wretched beings, such as it is, must be prepared ; within this space they must eat and drink—men, women, and children must strip, dress, and sleep. In cases of illness

the calls of nature must be relieved, and when death releases one of the inmates, the corpse must, of necessity, remain for days within the room. Let it not be supposed that I have selected some solitary spot for this description. No, I am speaking of an entire district, and state facts incontrovertible. I indulge in no theories as to the causes which produce this state of things, but I state the results. They are, that every cause that can contribute to generate contagion exists here in full vigour, and that disease in every aggravated form, with all its train of desolating misery, is rarely absent." An intelligent practitioner has informed me that some years ago in Cole-alley, he attended 5 persons in fever at the same time, and that there were 15 other persons in the same room. It is surprising we do not hear of infants being suffocated by overlying, for in the West Middlesex district, London, it is stated that 150 children annually lose their lives in this way, or by the want of fresh air when covered by the bed-clothes.

The air in nearly every one of the rooms of the poor I have visited is most foul, the windows very rarely being made to open above, and are almost never opened at the bottom; in many sleeping rooms there are no fire-places, and thus at night, when every crevice is closed, the air is so poisonous that the inmates are only saved from suffocation by the endurance which habit produces. The sunlight, which is most healthful and purifying to the air, rarely enters such rooms, as they are surrounded frequently by very high houses, and the windows are darkened by dust. What has been done to remedy these fearful evils by providing fit habitations for the poor? The Towns Improvement Clauses Act declares, that no cellers less than seven feet high, without a window, and of which more than two-thirds is below the level of the street, shall be inhabited; and upon this authority our Corporation has done immense good by closing over 3,000 such dens. There are many alleys and courts which should be pulled

down, for they are too dilapidated and ill-constructed to be repaired—such as Gill's-square, Calford's-court, and many places in the parish of St. Michan's; and in the case of many courts, they should be converted into thoroughfares by removing the end houses.

The Rathmines and Rathcoole Railway, which will pass through Exchequer-street, Fade-street, Stephen-street, Wood-street, Bishop-street, and Kevin-street, will remove many wretched dwellings; but it is much to be desired that benevolent and enterprising men will endeavour to substitute other more decent houses for the poor, as has been done on so large a scale by the Imperial Government in Paris, while the magnificent improvements in that city are being carried out. Should this be neglected, the only effect will be to drive the poor from one nest of unwholesome dwellings to others in the neighbourhood, and thus make matters worse than before.

The only achievements in this direction in this city, which I am aware of, have been made by Mr. Thomas Vance, Dr. Evory Kennedy, and Alderman Martin. Mr. Vance has built houses capable of accommodating thirty families in the most comfortable way, in Chapel-lane, Lower Bridge-street—baths, lavatories, wash and mangling rooms being provided free of expense, and he is adopting the same plan in Bishop-street and Kevin-street. Dr. Kennedy has erected admirable houses off Summer-hill, which are now set in rooms. I believe that no pecuniary loss has resulted from these most praiseworthy efforts; and if they were carried out extensively, as by a company like those in London, where they are commercially successful, the moral, social, and sanitary conditions of the poor of Dublin, would be amazingly elevated.

I shall now bring forward the statistics of one disease—namely, fever—because it is an unwelcome visitor from which we are never free, and is most largely preventible by sanitary measures; yet some years ago,

within twelve months, 80 cases had occurred in one house, 50 had been admitted into hospital from another, and in a third, at the same time, 15 persons were lying ill of it. At the same period it was shown that fever was more rife in places where there were sewers with imperfect traps than in those altogether undrained.—Last January (1864) was not remarkable for any climatic condition likely to promote the spread of fever, yet 229 cases were admitted during that month into the Hardwicke, Cork-street, and Meath Hospitals. These institutions have received 35,657 patients with fevers during the past ten years, as seen in this table, of which most of the figures are given on the authority of that benevolent nobleman, Lord Talbot, who has given such zealous aid to our medical charities:

Year.	Admissions.	Deaths.	Mortality per cent.	Proportion of cases to population.
1854	4396	385	8·75	1 in 57
1855	4492	362	8·60	„ 56
1856	3721	266	7·15	„ 68
1857	3534	268	7·58	„ 72
1858	3108	229	7·35	„ 81
1859	3466	226	6·50	„ 73
1860	2848	196	6·95	„ 89
1861	3310	209	6·31	„ 77
1862	3218	220	6·84	„ 79
1863	3564	222	6·23	„ 71
10 years.	35657	2583	7.27	„ 7

These returns only show portion of the cases which have occurred, for many are treated at their homes, or in the poorhouses and some general hospitals. In the 104 registered lodging-houses throughout the city which are regularly inspected by the Corporation officers, but one case of fever occurred last year, which is a very gratifying instance of the benefits of sanitary efforts.

If, then, it be true that Dublin has been more un-

healthy than needs be, I feel confident that the authorities into whose custody its well-being is entrusted, are determined that it shall be so no longer. Their achievements in improving the drainage of the city, closing uninhabitable cellars, inspecting lodging-houses, slaughter-yards, bake-houses, and other premises where nuisances are apt to arise, and, above all, their labours to procure an abundant supply of pure water, show that they are at least not behind the times in their appreciation of the value of sanitary reforms. I rejoice to say that I am now associated with them in such good works, and if in performing the duties of Medical Officer of Health I shall attain the same measure of success which has followed the labours of my colleagues in other cities, and become the humble instrument by which discomfort or disease among the citizens shall be diminished, or mortality reduced, I feel that no energy which I can command could be better rewarded.

I shall avail myself of the powers which the favour of the Town Council has conferred on me to make myself minutely acquainted with the causes which operate on the health of this city, with the condition and habits of the labouring population, and with the remedies and appliances which have been devised elsewhere, or which may be suggested here to bring about a better state of things.

I am well aware that the favourable reception which I have received from so large and influential an assembly is not due to my own merits as a lecturer, but to the practical importance of the topics with which I have had to deal. The intelligent portion of the Irish community have come to recognize the necessity of sanitary reform, and are resolved that, so far as in them lies, Ireland shall not lag behind other civilized nations in cleanliness, temperance, or in physical and moral well-being. With such a conviction abroad, and such a resolution generally diffused among the natural leaders of

public opinion, the work of the conscientious lecturer, however moderate be his talents, becomes prolific of good; at all events, animated with this hope, I shall labour earnestly to render my future lectures less unworthy of your approbation.

However inadequate may be my powers, or indeed the powers of any single person, to cope with the multifarious topics included under the term of "Public Health," I trust that I shall keep steadily before me an adequate ideal of what that term really denotes. As the health of the individual means more than the mere absence of specific disease—as it means the pleasurable and vigorous performance of every physical and intellectual function, the health of a community means not merely that it is not decimated with zymotic diseases, wasted with famine, or poisoned with miasms, but that it enjoys the highest degree of vitality that it is susceptible of, and has opportunities for all manly exercises and all innocent and beneficial pleasures.

The physical type of the Irishman, as has been proved on every battle-field in Europe, on the prairies of the West, and in the wild Australian bush, is inferior to that of no other variety of our species; while his patient endurance under severe trial, and happy freedom from crime, render his race worthy of strenuous efforts towards the amelioration of his social and sanitary condition. We are blessed with a fertile soil and a genial climate; our coasts swarm with food—a rich harvest for Cornish, Manx, or Scottish industry; and although no great arsenal or dockyard gives employment to our people, our harbours and estuaries are not surpassed by any in the sister kingdom. There is no reason why our people should not be industrious, cleanly, healthy, and prosperous, if only we resolve they shall be so, and that we endeavour to undo, by every legitimate effort, the evils which have gathered upon us through indifference or neglect.

LECTURE II.

AIR—ITS IMPURITIES, AND POLLUTION FROM FACTORIES.

As the prime necessity of human life is air, the first and last act of our existence to breathe it, and the most essential condition of health is its purity, all-sufficient Nature provides the most perfect means for accomplishing these requirements. The atmosphere around us extends to the distance of forty-five miles from the surface, but with uniformly decreasing density, and thus forms a covering for the earth in thickness about 1-160th of its diameter. This medium has the effect of moderating and diffusing the heating and lighting rays of the sun, which, were it absent, would scorch the living world, and submit us daily to a sudden and painful transition from glaring sunshine to total darkness at sunset, and the reverse at sunrise. In becoming rarified by the sun's heat, endless motion is produced in the atmosphere, giving rise to winds varying in force from the gentle breeze to the all-destroying tornado. The sun's heat raises water from the lakes and oceans, and steeps the air with moisture, which returns again to earth as refreshing rain, after washing the atmosphere and becoming charged with the foods of plants. So vast a quantity as 90,000 cubic miles of water thus circulates every year through the atmosphere. Without an atmosphere all would be silence—the thousand cheering murmurs of natural moving objects about us, entrancing music, and articulate speech could have no existence.

The physical properties of this fluid are chiefly negative, so that our senses do not readily perceive its presence—a circumstance which accounts for the negligence with which we treat it, taking no care that we shall aid Nature in preserving its purity. It is, when pure, transparent, colourless, inodorous, tasteless, and so elastic that it may be condensed to nearly the specific gravity of water, or expanded by a dull, red heat to thrice its volume—never, however, losing its proper gaseous condition. It is ponderable, 100 cubic inches at 60° of temperature and 30° of barometric pressure weighing 31 grains. A still stronger impression of its weight will be conceived when it is remembered that a column of air one inch square will weigh 15 lbs., or will balance such a column of mercury 30 inches, or of water 33 feet high; but the pressure of this great superincumbent weight is unfelt by us, because of its perfect diffusion, the force in one direction, upon the surface of our bodies, being resisted equally in another. The air decreases in density so rapidly that four-fifths of the atmosphere by weight is within eight miles of the earth, leaving but one-fifth for the remaining thirty-seven miles; so that at the utmost limit 1 cubic inch would have expanded to 12,000, and it also loses 1° of heat for each 350 feet of ascent. The boiling point of water is a fair indication of the weight of the air, and thus the height of any place may be ascertained—while it is 212° at sea level, it is but 187° at the summit of Mont Blanc. Concerning the chemical composition of the atmosphere I shall be brief, and after directing your attention to its usual constituents, I shall one by one explain the uses of those that are healthful, and which fulfil purposes in the economy of man, and the effects of those that are hurtful.

Everything which can assume the gaseous form may be found occasionally in the atmosphere; but in the following table is displayed the

Composition of Air and its occasional Impurities.

Oxygen		20·61
Nitrogen		77·95
Aqueous Vapour ...		1·40
Carbonic Acid		·04
Organic Matter Ozone Ammonia Nitric Acid Carburetted Hydrogen Sulphuretted Hydrogen Sulphurous Acid Chlorine Carbonic Oxide, &c.	...	Variable.

Oxygen has been long regarded as the essential material of air, but as its effects would be too stimulating if pure, it is diluted by four times its volume of nitrogen—a gas whose negative properties admirably fit it for this office. By volume the amount of oxygen in the 100 parts is 20·80, and so perfect is the admixture of gases by diffusion that, at great heights, at the sea level, in the open country, and in the confined city, it varies but little from that standard :

Paris	20·93	Simplon (6000 ft.)	19·98
London sea level	20·92	Snowdon (3570 ft.)	20·65
Open country ...	21·00	Mt. Blanc (16000 ft.)	20·96

When this uniformity was first discovered, the chemist was almost disbelieved, as every one felt the difference between the bracing country air and that of the crowded city ; but we shall see hereafter that these characters depend on far different constituents than the essential gases oxygen and nitrogen.

Oxygen is the supporter of combustion, and so much is thus used that it is calculated that one ordinary iron-smelting furnace consumes daily over sixty tons weight,

or as much as 200,000 men would require in the same time.

In the human body oxygen is the great motor power. Introduced by breathing into the air-cells of the lungs, which number five or six millions, it is seized by the red cells of the blood, carried throughout every tissue to combine with its carbon and hydrogen, thereby producing combustion and extricating heat; and as oxidation is the source of all functions of the human body, it is concerned alike in such diverse acts as the contraction of our muscles and the production of thought. Complete denial of oxygen must, then, prove rapidly fatal, and a diminished supply should be injurious; but so perfect are nature's provisions for affording an equable supply, that we do not meet with death or disease from this cause unless produced by violent mechanical means.

In 1840, Schönbein discovered at the platinum pole of the galvanic battery, while decomposing water, a body which, from its peculiar smell, he named "ozone." It is not a new body, but oxygen, either in an allotropic form or in some peculiar electric state. It is evolved while the electrical machine is being turned, when sparks are transmitted through a confined portion of air, and is most readily prepared by placing a clean stick of phosphorus, covered by distilled water, in a large bottle of air with a close-fitting stopper. When the bottle is kept at about 65° for from twenty to forty minutes, the phosphorus is oxidized, and ozone is set free in the air above it. Its chemical powers are those of producing the most intense oxidation and bleaching of all organic colours; for instance, uric acid is converted into urea—a change which, by the way, is wanting in the human body when affected by gout—and litmus blue is discharged. But the property which interests us most is that of disinfecting all foul organic effluvia by oxidation, and therefore its absence is a fair presumptive test that such matters are being emitted in the vicinity, and

vice versa. It is Nature's great scavenging agent, and is for this purpose being constantly generated by electrical disturbances. Ozone is contained in the alkaline permanganates—hence (as I shall presently explain) their eminently disinfecting power—and in chlorate of potash, to which fact I would assign much of the remarkable influence of that salt in decomposing the morbid matters in rheumatic fever and some other blood diseases.

To discover the presence of ozone in the air, slips of clean calico, about three inches long and one broad, should be soaked in the following mixture :—Dissolve 10 grains of pure iodide of potassium in 2,000 grains of distilled water, add 100 grains of starch in fine powder, mix, and gently heat till the solution thickens. One of these slips, when dry, should be suspended in this box of perforated and blackened tin arranged in spirals, contrived by Mr. Lowe, which, while excluding the light, admits a free current of air, and which, according to this meteorologist, should be suspended at a few feet from the ground for twenty-four hours. If ozone has been present the slip will be browned, the shades differing according to the amount of the gas present, and they are comparable by a chromatic scale ranging over ten degrees which has been constructed. When wetted, the colour changes from brown to an iron grey, or the well-know blue tint due to the action of the iodine on the starch. Ozone abounds in sea air, for Faraday found it readily at the shore at Brighton, while no trace could be discovered in the town ; neither could Angus Smith detect its presence in the air of Manchester, which is so polluted by the smoke of the factories.

In March, 1864, I made several experiments in the way above described, and I was unable to discover ozone in many streets and close places within the city ; but in the centre of Stephen's-green it was abundant, the calico slip being stained in one hour and a-quarter. At Kingstown eastern pier three-quarters of an hour

produced an equal effect. It is stated never to have been found in the interior of inhabited houses ; but I found that when the slip was suspended in my bedroom, in Stephen's-green, west, five feet from the window, which was left open, it was coloured in four hours, but was not at all affected in twenty-four hours when the windows and doors were kept closed. Fixed to the sill the stain was apparent in three hours. I should in candour state that many able chemists have assigned the effects produced upon this test to the action of acids, chlorine, or organic matter in the atmosphere ; but it should be remembered that the slips are stained at sea and at high levels, where these sources of fallacy are most unlikely to exist, while they are unaffected in large towns, in which such matters are abundantly generated. Moreover, the production of the most decided effects in cold and wet weather, especially at night, with a westerly wind, and after a fall of snow, and their non-occurrence for precisely one-third of the days in the year, entirely set aside these objections.

As regards the occurrence of certain zymotic diseases during the absence of ozone, surmises are plenty ; but the following facts, noted by my late lamented friend, Dr. Herbert Barker, after two years of most accurate meteorological observations, are reliable. Of 315 cases of diarrhœa, 246 took place during its absence ; of influenza, 81 out of 109 ; of meazles, 26 out of 36 ; of ague, 9 out of 11 ; of typhus, 6 out of 7 ; and of erysipelas, 12 out of 13. On the contrary, small-pox and scarlatina were more prevalent while ozone was discoverable.

Mixed but not combined with the atmosphere, there is always a variable amount of watery vapour, 0·35 grains being the utmost quantity which 100 cubic inches at 57° can take up. This is equivalent to about ·017 of its volume. As the temperature increases the air becomes more dry, and is capable of absorbing more

water. The most healthful amount of vapor may be considered as about 70 degrees, the utmost saturation being about 100. A dry air is very irritating to the breathing passages, as it absorbs moisture as well as heat from them. The rise in temperature is, however, necessary, for if air be admitted directly through the wind-pipe, when that tube has been cut suicidally, or by the surgeon, its coldness excites fatal bronchitis. The spontaneous evaporation which supplies water to the atmosphere varies with the motion of the air as well as with temperature—facts which were demonstrated by Dalton. He exposed a vessel of water, six inches in diameter, at various temperatures, to still, gently moving, and briskly moving conditions of the atmosphere with the following results :

Temperature.	Grains of water evaporated.		
	Still.	Gentle.	Brisk.
40° ...	1·05	1·35	1·65
50 ...	1·50	1·92	2·36
60 ...	2·10	2·70	3·30
212 ...	120·	154·	189·

While water is evaporating much heat is rendered latent by the vapor, and is abstracted from the wet surface, so that water may be even frozen by producing evaporation around it ; thus it is that we are the more apt to take cold with wet clothes the warmer the air about us is, and the danger can be avoided by wrapping round us a dry covering to check evaporation—a principle the Scotch shepherd follows when he rolls himself in his plaid, which he has kept dry during the shower. The aqueous vapor in the air is essential to vegetation and to animal respiration, but if it be decreased or increased beyond the normal point, injury results ; and we shall hereafter see that one of the evils of want of ventilation is that the air of our rooms becomes almost saturated to the utmost by the moisture evolved from

the lungs and skin of the inmates, and from the combustion of our lighting agents.

About 1-2000th of the volume of air is carbonic acid, more in summer, less in winter. So perfect is the diffusion of gases, that although this gas is one-and-a-half times as heavy as air, there is no more of it on the surface of the earth, at sea level, than at the summit of Mont Blanc. Indeed, in very high places, from the absence of vegetation which in other situations removes it, there is found the greatest proportion of this gas. Nature's means, then, for distributing this gas are perfect. Are those of art? Let the following facts answer:—Professor Roscoe found the amount of carbonic acid in the air of the gallery of a theatre to be nine times, and that of a crowded school-room eight times, as much as in the surrounding open air; and Leblanc found it respectively five, ten, and twelve times as abundant in the air of three Paris hospitals as in the atmosphere outside them. Combustion, respiration, fermentation, and decay produce this gas so abundantly that animal life would be extinguished, did not plants proportionally remove it, in performing their function in that organic cycle which has always been regarded as one of the marvels of creative perfection.

The deadly lake of Java, whose borders are strewn with human and other skeletons, and the Grotto del Cane, are well-known natural lurking places for carbonic acid; and brewers' vats and deep wells are artificial ones, due to the generation of the gas being more rapid than can be removed by diffusion; and death has often occurred from entering them until purified by free airing or the action of slaked lime. Near Swords a lamentable instance recently occurred, in which five persons lost their lives in a manure-tank, the last four having successively endeavoured to rescue the first victim. The teaching of the poor in the laws of life and health would have obviated this and many other distressing calamities. It is

often said that if air in such situations will support the burning of a flame, it will sustain life; but this test in some cases has been fallacious.

Other sources by which the atmosphere of towns is polluted are the carbonic acid and ammoniacal gases which issue from intramural churchyards and burial-vaults, the air in the latter having been found by Dr. Waller Lewis always so impure as to extinguish flame. Legal enactments have to a great extent checked this evil in England, and, as I shall in another lecture prove, there is pressing need for their extension to Ireland. In manufacturing towns the amount of carbonic acid evolved is enormous; thus Angus Smith calculates that in Manchester 15,000 tons are daily thrown into the atmosphere.

Although no one can doubt the poisonous nature of carbonic acid when introduced freely into the lungs, the belief, however, that more harm is done by the organic matter, which in expired air is its constant companion, than by that gas itself, gains support from the fact that it may be freely introduced into the stomach, as when we drink soda water and other effervescing beverages, with useful instead of hurtful effects. In over-crowded rooms, when the window is opened, the carbonic acid rapidly escapes, but not so the organic matter, which adheres closely about the furniture, &c. Carbonic oxide is far more poisonous, by destroying the power of the red cells of the blood for conveying oxygen. Undiluted carbonic acid and other irritating gases—as nitric oxide, nitrous acid, chlorine, and ammonia—are instantly refused admission by the ever-watchful muscles which guard the opening of our breathing passages. Ammonia from animal and vegetal putrefaction, and nitric acid formed by the combination of the nitrogen and oxygen after electrical changes, are pretty constantly to be found in the atmosphere, whence they fall in rain to nourish plants. Upon man we are unaware that they produce

influence either healthful or hurtful; and with that selfishness which views as useless all things which do not plainly benefit him, they have been called "accidental constituents."

I now proceed to those constituents of the atmosphere which serve no useful purpose, but, on the contrary, are most injurious to human health; and remember that man, not Nature, is to be blamed for their presence.

The gases which untrapped sewers and cesspools emit into the air are mainly sulphuretted hydrogen, sulphide of ammonium, carbonic acid, and nitrogen. As regards the noxious influence of the first on animals, the experiments of the late Dr. Herbert Barker are very conclusive. A dog was placed in an atmosphere consisting of 12 cubic inches of sulphuretted hydrogen to 5,820 of air, or about 2 per 1,000. "Within a minute he fell on his side and was seized with tremors; the action of the heart became irregular, and within four minutes the respiration had apparently ceased. It returned, however, and became very rapid. He was exposed one hour forty-eight minutes. He next became universally cold, jerking of his muscles followed, and he died eight hours after removal. The most frequent post-mortem conditions in this and similar experiments were extreme fulness of the right side of the heart, and a crenated and broken-up state of the blood cells." In one case "but one was natural." I shall quote another experiment.

"A common hedge-sparrow was put into the box as before with six cubic inches of sulphuretted hydrogen (to 5,826 of air). Within two minutes he fell down insensible, and continued in this state for the space of one minute. The respiration then became very hurried and gasping. He rose, but staggered a good deal, and fell again on his back. Six minutes after the commencement of the experiment he vomited, became convulsed, and died in fifteen minutes." Now, the proportion of this gas to the atmosphere in the vicinity of neglected

sewers and of some manufactories may be quite as great as in these experiments, although imperceptible to the senses.

This gas issues from fissures torn open in volcanic countries, as at Puzzuoli in Italy, and is disengaged when iron pyrites from coal mines is allowed to decompose in the air, or from some ill-arranged chemical factories; and in all these cases effects very similar to those described above have occasionally followed exposure to it.

The air in sewers is generally strongly alkaline from ammonia, its carbonate, or sulphide of ammonium, which fæcal matters evolve; and, in addition, it shows a deficiency of one-third of its oxygen, and a very large amount of peculiar organic vapour. Meat very soon taints in sewer-air, and organic matter, including infusorial germs, is most abundant. The proportion of sulphuretted hydrogen has been found 25 per 1,000, or 25 times as much as sufficed to kill the animal in the last-quoted experiment. Parent-Duchâtelet has been often quoted as having proved that the sewer-cleaners of Paris are not more subject to disease than other workmen, but he has really shown that they were subject to diarrhœa, colic, and sore eyes; and Dr. Murchison has shown that the same class in London is very prone to catch typhoid fever. If, then, we are alive to the pernicious character of sewer gases, with what feelings will we regard a sewer under our house, or an untrapped or badly-trapped gully! Many sulphur compounds are introduced into the air by coal-gas, in 100 cubic feet of which as much as 60 grains of sulphur have been found. The maximum allowed in Gas Acts is 20.

The suspended impurities of air include both mineral and organic particles which float about, usually invisibly, but if a ray of sunlight be let through an aperture into a dark room, such particles will be seen in rapid motion.

The mineral are mainly chalky or aluminous dust, which becomes deposited in the lungs, although there are millions of little hair-like bodies fixed along the lining of the breathing organs to fan them out; and thus it is the inhabitants of cities, and of mines especially, are found after death to have much blacker lungs than those who live in a cleaner air. Spectral analysis has discovered—I should rather say exhibited—common salt and chloride of magnesium floating about in sea air—for ten years ago that delightful writer, the late Prof. Johnston, proved that they were present.

But the putrescible organic impurities are those we have most to dread, and they constitute 40 per cent. of the entire dust, or 46 per cent. of those obtained in the air of a ward of the St. Louis Hospital, Paris. Amongst those that are animal are a variety of *débris*, such as particles of the human cuticle or surface-skin; during summer, in towns, finely-powdered horse-dung and the grindings of shoe-leather; germs of minute animals, such as monads, vibriones, and bacteria—the latter of which has been shown to cause disease in sheep—and pus-cells, all of which are demonstrable by the microscope; and we have the strongest reasons for believing that the poisons of small-pox, scarlatina, measles, &c., are thus disseminated through the atmosphere, and become capable of producing the disease when moistened or planted in a fit soil—namely, the body of a susceptible person. Cotton fibres, starch-cells, spores, and many kinds of fungi, are some of those objects of vegetal origin which the microscope exhibits; in addition to which there are the odoriferous particles from plants and animal matters which elude all our senses but that of smell. Ehrenberg asserts that he has distinguished by the microscope some hundreds of organic forms in dust collected from the air; and air deprived of them, by being thoroughly filtered, is so remarkably altered that it will not support the processes of putrefaction or fermentation. Most of

the varieties of fermentation are dependent on microscopic vegetal forms, but what is known as butyric depends on the presence of a small animal, the vibrio, which can only live when air is excluded. This is a fact which should give confidence in the efficacy of ventilation.

There are great difficulties in collecting the peculiar organic matter which emanates from the lungs in expired air. The best method is to suspend a clean and dry glass globe filled with ice in a room as air-tight as possible where a number of people are breathing; or it may be collected by passing the air through the "aëroscope," an instrument which consists of a funnel with a very small orifice, in which is inserted obliquely, so that the current may impinge on it, a piece of glass moistened with glycerin. The watery vapor containing the organic matter is then deposited on the surface. As much as 240 grains has been set down as the daily amount of this animal matter from the lungs and skin of each individual, but this is probably an exaggeration. When drawn through water it renders it very offensive. It contains nitrogen abundantly, as it gives a red colour with nitrate of silver, and produces ammonia when distilled with lime. It is said to fix most easily on black surfaces, and all hygrometric substances absorb it, owing to the water with which it is combined. The amount of carbonic acid in the air, which is so readily determined, is not a positive guide as to the amount of organic matter which accompanies it, and until Dr. Angus Smith applied himself to the point, we had no means of measuring it. A solution of the permanganate of potash loses colour in contact with organic matter, to which it gives ozone or oxygen. From this instability of tint this salt has been long known as the mineral chameleon. Dr. Smith took measured quantities of air, and added definite quantities of solution of the permanganate, and the less of this was decolorized, the more free was the air of organic purity.

The following are a few of the striking results he obtained with the apparatus, which he named the Septometer.

In a closely-packed railway-carriage, in his laboratory where the sewerage was leaky, and in a yard behind some filthy houses, there was twenty-five times as much organic matter in the air as on high ground thirty miles north of Manchester; in a bed-room there was three times as much, and the amount was found to have been considerably increased after the room had been slept in.

In applying this method to determine the purity of the air in various places in this city, I modified the plan merely for convenience sake. I filled this accurately graduated aspirator with water, and attached it to a set of Ure's bulbs, containing a measured number of grains of a solution of permanganate of potash, of strength determined by the effect of oxalic acid upon it. As the water flowed from the aspirator the air bubbled slowly through the solution, the number of cubic inches which passed before the solution was decolorized being an index of its purity. I quote the three following experiments upon the same quantity of the permanganate tion as affording the best comparative results:

Centre of Stephen's green -	3,000	cubic inches.
Dissecting-room, containing about nine subjects -	975	,,
Room in Braithwaite-street in which thirteen persons had slept, and before the windows had been opened	350	,,

These quantities of air produced the same effect upon equal measures of the solution; or, in other words, the air of the human dwelling was nearly three times as impure as that of the dissecting-room, and nine times as much so as that of Stephen's-green. A rough estimate

of the impurity of the air in any close place may be made by noting the time which is required to decolorize a few drops of Condy's fluid added to a little water in a white saucer. In hospitals the amount of organic matter is immensely greater than in dwellings, and ventilation should be therefore most abundant.

The unbearable stench in the houses of the poor in Russia, at the setting in of warm weather, is due to the decomposition of organic matter emitted from the lungs and skins of the inmates, which has been frozen and preserved during the preceding cold months. In this way may be explained the anomalous circumstance that the advent of winter does not check the spread of cholera in that empire. In all over-crowded rooms the air contains cells cast from the cutaneous or mucous surfaces of the inmates.

The most suggestive fact of all that bear on this subject, and the communicability of disease through the air, is the discovery of pus-cells in the air of a ward, containing thirty-three patients, in the Orphan Asylum of Prague, during an epidemic of purulent or contagious ophthalmia—for there could not be any doubt as to the manner in which the disease spread from the eyes of one patient to those of others ; and I know of a charity school in London in which 500 cases were thus produced. In the army, ophthalmia is a most frequent cause of discharge from service—for instance, 9 per cent. of those in 1860. Want of ventilation and of separate means of ablution promoted the spread of the disease, which, however, was chiefly disseminated during the Napoleonic wars among the military, and subsequently the civil population. It is probable that pus-cells dried may reproduce their contagious properties on being moistened, in the same way as dried single-celled plants—the protococcus, for instance, will germinate when moistened.

The poisonous effects of air impregnated with arsenical dust, detached from wall-papers and dresses coloured

green with such compounds, attracted much notice a few years ago, and for the sake of those who were forced to work on them, more than of those whose vanity tempted them to encourage their production, the process should have been suppressed, unless it could have been rendered harmless by scientific expedients.

The following are some of the most usual exhalations from factories which have been the subject of legal contention under the Nuisances Acts:—Sulphurous and even sulphuric acids from vitriol and copper-smelting works; hydrochloric acid from alkali works; fumes of arsenic and sulphurous acid from copper and lead-smelting furnaces; carbonic acid and carbonic oxide from cement works; and from negligently conducted soap and candle manufactories, disgusting rancid oil-gases, and even the injurious substance which chemists term acrolein, are emitted, which are equally nauseous and deleterious. Many factories are positive nuisances by the quantity of unburnt carbon they emit in the smoke, and this waste is very often in proportion to the cheapness of coal. Some kinds of fuel are very noxious by the evolution of sulphurous acid—an effect which might be prevented by mixing a little lime with it in the furnace.

The inhabitants of the south-eastern part of this city have complained that it is infested by certain smells which have been assigned to various causes; thus, the manure works, chemical works, gas works, and creasote factory, have all had their accusers; and others assign the stench to the mist which, with an easterly wind, is blown back up the river, charged with the odour of decomposing seaweed and sewage matters which had not been carried out to sea. Yards where rubbish is stored abound in this neighbourhood, and for some months before the complaints began two large sewers had been opened for cleansing, and these may have contributed their fetid exhalations. Amidst such a mixture of perfumes you will understand it was not very easy to de-

termine with the nasal organ the real offender. In treating this delicate subject, in which equal regard must be paid to the commercial interests involved and the general salubrity of any city, the duty of the medical adviser is concerned with the question, whether this or that establishment is prejudicial to the health of the citizens. The question whether certain smells are nauseous or not, is a very interesting one for those who live or own property in the vicinity, but is one which I do not think the legislature contemplates, and of which the physician is no better judge than other people. Prof. Cameron, the City Analyst, and I have examined into some of these alleged causes, and I will notice them fully to show the difficulties which surround the question.—Hydrochloric acid and chlorine are the vapours said to be given off from the chemical works, which are often known as "alkali works;" but after a careful examination of many of them, I could not discover any of the former gas in the atmosphere, except immediately near the retorts, and that the chlorine must escape to some amount is admitted and recognized by the enactment on the subject, passed in 1864 through the exertions of Lord Derby, which compels the absorption of only 95 per cent. of the gas. Some years ago all of it was allowed to escape, as they then had no use for it. The acid is, however, under control, yet that it escapes occasionally is often shown by the corrosion of metals and injury to vegetation in the vicinity; the slighest trace in air, if passed over a growing plant, will kill it in a couple of hours. Its effects upon animal life differ accordingly as it is concentrated or diluted—being in the former cases most suffocating, and in the latter not very palpably hurtful. It has been said that cattle grazing near muriatic acid works lose condition—as shown by fall of their hair—and suffer from disease of the bones. It was shown before the Committee of the House of Lords, in 1860, that plants were injured by this vapour

for two miles round such an establishment as St. Helen's, Lancashire. I would not regard chlorine in the air in small quantity as injurious, remembering its disinfecting powers.

The alkali works in Dublin are four, and in them oil of vitriol, muriatic acid, and bleaching powder are manufactured, and the gases which are liable to escape are sulphurous acid, muriatic acid, and chlorine. Complaints have been made of these disagreeably-smelling gases by persons living around, and the iron of neighbouring works is rusted. On damp days, when the air is so light that these gases do not ascend, and when the wind is blowing from the east, the smell from these works has been perceived at least a mile distant. The smell is, no doubt, unpleasant, but I have had no evidence that the gases have been so concentrated as to injure vegetation, and in small quantities they are not injurious to health—but, on the contrary, by destroying organic impurity, they may be serviceable. Under the suggestions of Prof. Cameron and myself, the proprietors have had great care employed in the stanching of all their apparatus, and a plan has been originated for condensing the waste chlorine by drawing it through lime and water. Their coal is burned so as to emit little smoke. The porter of a neighbouring brewery having been soured by the acids emitted into the atmosphere from one of these alkali works last year, legal proceedings were entered into and an arrangement was made, under which the chemical works were to be removed. Owing to the dilapidated state of the buildings of another of these works, gases escaped freely, and were very unpleasant to those passing near them, but at present they are being repaired. The inspectors under the Alkali Act, Drs. Angus Smith and Blatherick, report that two per cent. only of muriatic acid escapes in the Irish works, but in one-third of the works of the whole kingdom no escape whatever is permitted.

Another manufacturer distils the tar from the gas works, and obtains oils containing carbolic acid in the impure state, or creosote, and pitch from them. Dense fumes occasionally escape from the melted pitch, but they do not extend far, and I cannot regard them as very deleterious. In other premises, also at the eastern end of the city, the ammoniacal liquor from both the gas works is received through pipes, and treated with oil of vitriol, or muriatic acid, to obtain salts of ammonia. Sulphuretted hydrogen escapes, and until Prof. Cameron and I visited the premises this pernicious and abominably stinking gas was sent into the air through a high chimney, and, under certain atmospheric conditions, it occasionally descended, to the serious detriment of the citizens. At our suggestion the proprietor has made arrangements by which this gas is carried through a fire and thus destroyed.

In the manure works blood is dried, and if it be not kept till it decomposes, or if it be not charred, no smell ought to issue; and fish offal is dissolved by sulphuric acid to mix with greaves, coprolites, wool, and other refuse. Upon three separate occasions I have not been able to detect sulphuretted hydrogen or ammonia in the air about this yard; and the smell, which is disagreable no doubt, depends on some organic matter—probably a fatty acid—emitted from the fish under the action of the sulphuric acid. It had given great annoyance to the congregation of a church which is immediately opposite, but as the vapour is very dense, it is not wafted to any considerable distance. Chloride of lime having been freely used about the yard, the nuisance was somewhat abated. The owner is under promise to mix the materials in covered vessels, and to draw the vapor into a tall chimney, and unless these precautions are adopted before he re-commences the manufacture this season, I shall feel it my duty to advise prosecution. The soil in this neighbourhood seems soaked with sulphur com-

pounds, for some water which I obtained from a shallow well contained sulphuretted hydrogen abundantly, and smelt very badly. This, in my opinion, is due to the lime water charged with sulphur compounds—or what the workmen call "blue Billy water," which has been used for purifying gas—being cast into the sewer.

In both the gas works, the mode of purification had been by the wet lime process, and the resulting refuse was conveyed into open tanks for the purpose of allowing the undissolved lime to settle from it. This lime was afterwards used as luting for the retorts, and the water is pumped under the furnaces where it is consumed. At the open part of the sewer in Benson-street, which has been recently covered in, about thirty yards from where the boy was suffocated in July, 1864, this refuse water might have been often seen. I believed that sulphuretted hydrogen escaped from the tanks while the refuse was exposed to the air, from the luting of the retorts, and from the water while being dried upon the furnace pans; and I am convinced that such escape was most injurious to the health of the workmen and surrounding population. My opinion was painfully verified by the suffocation of three men by sulphuretted hydrogen in a pit dug in the premises of the Alliance works in September, 1865. The lime refuse must have percolated from the tanks into the surrounding earth. Unwilling that so great, and in the beginning so expensive a change should be urged upon the companies without my opinion being supported by London and other authorities, I wrote to the Medical Officers of Health of nine English districts. All condemned the lime process, and approved of the iron process, except one eminent chemist, who stated that with proper precaution the wet lime process need not be a nuisance injurious to health. I also consulted several eminent gas engineers, and quoted authorities such as "Muspratt's Chemistry," "Barlow's Chemistry of Gas Lighting," "Hughes' Treatise on Gas

Works," and thus produced much evidence upon the noxious character of the wet lime process in a populous town. In order to determine the matter by personal inquiry, the Corporation commissioned me to examine the works in London and other English towns during October, 1865, and I accordingly visited the London, City of London, Phœnix, Equitable, Chartered, Imperial, York, and Scarboro' Works, and ascertained that, in all, the lime process had been found to produce nuisance, and that, therefore, the oxide of iron process had been substituted.

It may not be out of place if I briefly sketch the oxide of iron process, as I saw it carried out in London. Oxide of iron, or ferruginous clay, mixed with saw-dust, is exposed to the gas, from which it takes the sulphur, and the carbonic acid is taken afterwards by a little dry lime, and the resulting chalk is in no way injurious. The iron mixture containing the sulphur is exposed in thin layers to the atmosphere, when some of the sulphur is discharged in a perfectly harmless state, and the remaining iron is again ready for use or "revivified." After being used several times, too much sulphur is retained, and it is therefore sent to the oil of vitriol maker, who burns the sulphur into that acid. These manufacturers are glad to supply the oxide of iron ready for use, on the condition of getting it back charged with sulphur; but the gas companies might sell the sulphur charged with iron to them at a profit. In some London works the ammonia of gas is very perfectly fixed by Dr. Odling's mixture, which is saw-dust steeped in oil of vitriol. In none of the works I visited did any odour exist; and, further, the gas was very free from sulphur, ammonia, and carbonic acid. In the Phœnix works the wet lime process was, for some years, conducted with the additional step of burning the spent water in a special chamber; but it was found difficult to manage, and occasionally the great quantity of sulphurous acid proved a great nuisance.

The dry lime process, while it does not catch the impurities as well as the wet lime, produces a solid refuse so noxious that it is necessary to carry it away to sea in air-tight barges.

The only company which we now have has entered into a contract for the erection of purifying chambers by the iron process, during summer, when alone extensive changes can be made in gas works, and they will be in action immediately.

Gas refuse contains many compounds which, by the addition of an acid, give off prussic acid and sulphuretted hydrogen. Now, it was dicovered lately that much of the stench from the eastern end of the city resulted from this admixture in the sewer which drained the gas works, the factories where their refuse is used, and the waste acid of a vitriol works. Upon the proprietor of the latter making a sewer direct to the Liffey, the nuisance has been much abated. His acid refuse had also done much damage by corroding the sewers and the tide-gates, and other fittings connected with them.

The position of the 129 slaughter-houses scattered through the densest parts of the city is a subject which demands the earnest attention of the Dublin Council.

Notwithstanding the best water supply and sewerage, the earth in the neighbourhood of these places becomes imbued with the blood and refuse of the animals, and the air becomes polluted, much to the injury of the health of the surrounding residents. Whenever the earth in the vicinity is turned up for the laying of sewers or gas-pipes, it is found black, damp, and stinking. The plague in London, in 1349 and 1361, raged particularly in the neighbourhood of Smithfield, because of the pollution of the ground by offal, and all slaughtering in the city was forbidden by Edward III. A vigilant inspection of these houses is very difficult, on account of their scattered position, and a reliable or constant examina-

tion of the meat is impossible. In order to prevent the sale of unwholesome meat, whether rendered so by decomposition, parasitic animals, or other diseases, a careful examination, with the aid of the microscope, of every suspected carcase is much to be desired, but at present is quite unattainable. The driving of animals through the streets, and afterwards the carrying of their carcases on men's backs, is much complained of. The erection, therefore, of two, three, or four abattoirs and meat markets in different quarters of the city is, for such reasons, most desirable. The most suitable place on the north side is, certainly, the Cattle Market; and on the south the square bounded by William-street, Exchequer-street, George's-street, and Stephen-street would give space for an extensive market as well as abattoir. There are no slaughter-houses in the city of London; the butchers all slaughter at the abattoirs adjoining the metropolitan market at Islington, and carry the meat in covered carts to their stalls.

The houses and sheds in which cows are kept have been inspected repeatedly by our sanitary sergeants, but there are no legal powers to remedy such evils in them as over-crowding, the want of sewerage, and water-supply, and it would be very desirable that the provisions of the Metropolitan Management Act on this matter should be extended to Ireland.

As an example of the mode of procedure in cases of other injurious trades being carried on in populous neighbourhoods, the following case against a chandler and fat-boiler, at the request of persons living in the vicinity, may be reported. Evidence was given as to the nuisance by residents of the neighbourhood and by me. I also deposed that the premises were so small, and in so densely populated a place, that it would be very difficult to carry on the trade inoffensively, and that the proper remedies were as follows:—The erection of a chimney ten feet higher than any of the houses

around, the placing of a copper funnel over the boiler, which should then open into the chimney, glazing the windows, and hanging cloths wet with potash through the premises, which act by seizing the acid vapors. The magistrates made an order to discontinue the boiling of fat until these steps were completed, under a penalty of £5 per day. The owner subjected himself to this penalty on two occasions, but afterwards relinquished the boiling of fat, and has since merely melted pure tallow, which does not create nuisance. Another similar factory, which is close to an hospital exercise ground, was so offensive as to prevent the convalescents taking exercise.

Organic matter is also thrown into the air from the trade of cleansing and drying the guts of oxen, sheep, and pigs, and from the making of size ; but with a free water supply, good sewerage, and care, enforced by regular inspection, no nuisance occurs except in very hot weather. The boiling of bones in what are oddly called "marine stores," produces hurtful odors, but they may be prevented or much diminished by the erection of a funnel over the boiler, and the raising of the chimney.

As the rags in these places are often infected with contagious diseases, or filled with vermin, it is most desirable that they should be cleansed and disinfected; and the most ready way of so doing would be a chamber heated to 212° such as I shall afterwards describe.

The emission of smoke from factories is most injurious to health by obstructing sun-light—which is essential to the development of the human body—by the entrance of sooty particles into the lungs, and by compelling the roomkeepers in the vicinity of these factories to keep their windows closed, so that they suffer from a total want of airing. It is also injurious to the general appearance of cities. 113 such establishments in Dublin, including breweries, distilleries, foundries, printing-offices, malt-houses, and many others, were noticed to

take steps for the consuming of the smoke of their furnaces, according to the 108th section of the Towns' Improvement Clauses Act, 1847. A special apparatus for this purpose entailing great expense, and not being always effectual, the following simple directions to managers and stokers were issued :

INSTRUCTIONS FOR THE PREVENTION OF SMOKE.

Unconsumed smoke in the atmosphere having been shown to be detrimental to the health and property of the citizens, and otherwise injurious to the city, and, moreover, its prevention having been proved to be very feasible, the Committee are determined to exert the powers conferred on them under 10 and 11 Vic., cap. 34, sec. 108, for the prevention of smoke; but before doing so, they have had prepared the following simple instructions for the direction of the owners, managers, and stokers of all establishments where fuel is burned in places other than ordinary fire-grates.

1. The complete combustion of fuel depends on the admission of just enough air to the furnace. Too small a quantity allows some of the fuel to pass off in smoke, or in an imperfectly burned condition, producing GREAT WASTE; but if the amount of air admitted be too great, the heat will be reduced to an ineffective degree. When black smoke is seen to issue from the chimney, let the door of the furnace be opened. The draught entrance must be kept free of fuel or ashes at all times.

2. The furnace should never be choked up with fuel.

3. Before adding fresh fuel, most of the red coal at the front of the furnace should be raked to the back, and the fresh fuel placed upon the remnant in the front, so that all the matter issuing from the fresh fuel shall be burned by the bright fire at the back.

4. Large coal should be broken into pieces the size of the fist before being added to the furnace.

5. The quantity of red coal on the floor or bars of the

furnace should be equally distributed, and never less than three inches deep.

6. All furnaces and boilers hereafter to be erected shall be constructed under the superintendence of a competent engineer, and with the view to the prevention of, and the exit of, unconsumed smoke.

DIRECTIONS FOR STOKERS.

1. No black smoke ought to issue from the chimney of the furnaces.

2. To prevent this (when charging the furnace), push most of the red coal to the back of the furnace, and spread the remainder evenly to a depth of not less than three inches, and *place the fresh fuel upon the red fire nearest the door.*

3. The pieces of fresh fuel must not be larger than the fist, nor added in such quantity as to choke the furnace, as this prevents a sufficient quantity of air from entering, and thereby wastes the fuel and causes smoke.

4. If black smoke should issue from the chimney of the furnace, *it must be your fault*, and a fine will, therefore, be inflicted. When, however, it does occur, open the furnace door, stir up the black coal, and bring it in contact with the red fire.

N.B.—The Committee issue these instructions as suggestions only, and the owners or managers of furnaces are not thereby relieved in any way whatever from the obligation to use all other means for the like object, or from their legal liability in regard to smoke issuing into the atmosphere from their furnaces, or in any way to prejudice the legal rights of the Corporation to enforce observance of the statutes.

These suggestions have been very generally followed, and the atmosphere has been thereby rendered much less murky. Very constant supervision is required. Stokers very often neglect to put back the fire before

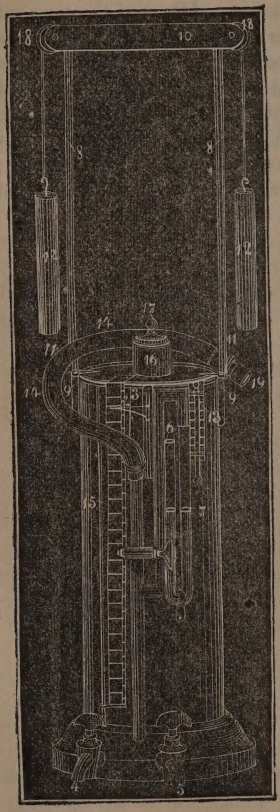
adding fresh fuel, and may not be above feeling interest in the profits of dealers of that article. As an instance of more complicated and expensive machinery for consuming smoke may be mentioned the chain furnaces employed at Mr. Guinness's brewery, where nearly thirty tons of coal are daily burned, and yet the amount of smoke is less than that of some factories, where not one-tenth the amount is used. In the same great establishment Chanter's "rocking bars" are also used with good effect. Prideaux's apparatus for the consumption of smoke has been very greatly praised; it allows the entrance of air freely when coal is put on, but lessens the supply during the intervals of coaling.

Besides the gaseous impurities and suspended particles which I have heretofore spoken of, there are other matters in the atmosphere too subtle for chemical tests, or for vision—assisted even by the most perfect artificial aids; but man is endowed with another sense by which they may be detected—namely, that of smell. There is little doubt that we are made sensible of odours by inconceivably small particles emitted from the odorous body, despite the often quoted experiment with a single grain of musk, which, after several years' exposure in a room which it perceptibly scented, was found not to have lost appreciably in weight. Another fact which shows the infinite minuteness of odorous particles is, that a single grain of a compound of the metal tellurium, if swallowed by a healthy man, will render his companionship intolerable for months. Speaking of such disgusting substances, Prof. Johnston remarked: "It may not be impossible to employ them as weapons of offence or defence. Imitating the habits of the skunk in this respect, we might far surpass it in the intensity and offensiveness of our artificial stinks. Squirted from the walls of a besieged city, projected into the interior of a fortified building, or diffused through the hold of a ship of war, the Greek fire would be nothing to them; and as

for the stink-pots of the Chinese, they must be mere bagatelles to the stenches we can prepare." For similar purposes it has been seriously proposed to fill shells and other projectiles with kakodyle, one of the most deadly of substances, both on account of its inflammability and the arsenic it contains. Many of the noxious gases give us warning of their presence by their disagreeable smell; but as I have before mentioned in respect to sulphuretted hydrogen, they must not be considered innocuous when so diluted with water that the mixture with air is inodorous; and they injure, not so much by actual or marked diseases, as by general depression, greater liability to catch diseases, and to bear up against them.

LECTURE III.

AIR CONTINUED—VENTILATION—WARMING—DISEASES DUE TO IMPURE AIR.



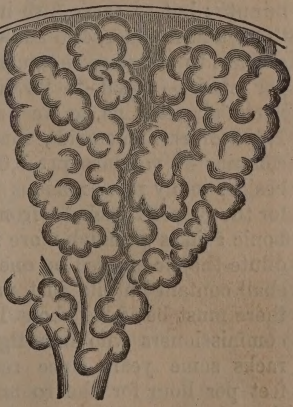
The Spirometer.

THE quantity of air we inhale at each ordinary breath we take, is most variable, and even an average quantity cannot be positively stated, which is to be regretted, being desirable as a datum on which to found principles of ventilation. One peculiar source of fallacy arises from the fact of our breathing more vigorously when attention is fixed on the act. The round number of 20 cubic inches is pretty near the truth, and it is worthy of note what a small proportion this bears to the utmost quantity we can inhale. An ordinary man of five feet eight inches in height, and ten stone weight, can expire 240 cubic inches from his lungs, as can be shown by this instrument—Hutchinson's spirometer—here figured.

The dry gas-meter I shall now use, which, by the way, was manufactured in Ireland, and displayed in our National Exhibition, makes

a much more handy and truthful instrument for determining the quantity of air we expire. The greatest amount ever expelled—464 cubic inches—was by an individual whom I might call a giant, as his height was seven feet and his weight twenty-two stone; and the least—46 cubic inches—from Don Francisco the dwarf, who was but twenty-nine inches high and forty pounds in weight. Women can take in much less air than men. The instrument is very reliable in examining lives for insurance, as any wide departure from the normal standard is indicative of some obstructive disease of the lungs, preventing their full expansion.

The amount of air breathed in varies remarkably with the dress of the body; thus a man was found to breathe nearly one-third more air when his ordinary clothing was removed from him. When such are the effects of our loose habiliments it cannot be necessary to descant upon the evils of tight-lacing. But were it not that woman breathes especially by the top of the chest, even greater injury would result. The air in passing through the mouth and breathing passages is warmed to nearly the heat of the body, and is strained of dust and other suspended matter by myriads of hair-like projections on the surface, which are constantly fanning to and fro. In the lung the air-tubes divide many times, and at last end in these dilatations; two of each, with the air-cells which jut from them, are here represented.—These air-cells, it is calculated, amount to the astonish-



Structure of the Lung.

ing number of 600,000,000; and on such a vast surface the blood is exposed to the air, by which it is freed of carbonic acid and supplied with oxygen. This all-important gas is then conveyed in the arterial blood all over the body, being required in the performance of every vital act. By examining the expired air it will be found to be warmer, more moist—as one perceives on a frosty day because of the condensation of the vapor—to have lost about 4 per cent. of its oxygen, and to have gained about an equal amount of carbonic acid gas. The proportion of the latter varies however remarkably, being increased under the following circumstances—cold, at noon, during spring, the taking of food, muscular exertion, and lastly in youth.

The amount of air required depends, then, on physiological data, which are not by any means positively settled. An ordinary man, I have stated, breathes in about 20 cubic inches of air about eighteen times per minute; but as every fifth inspiration is more vigorous, the round number, 400 cubic inches, seems to me a fair amount to assign as the quantity each man breathes out per minute—equal to 24,000 cubic inches per hour. Fresh air contains, as we have before seen, but 0·4 per 1,000 of carbonic acid; that which has been breathed contains 40 volumes per 1,000, or 100 times as much, besides many more noxious ingredients, which we shall for the present exclude from consideration, as the carbonic acid is so much more readily measured. Now, to dilute the air expired by one man in an hour, so that it shall contain but its just proportion of carbonic acid, there must be added about 1,660 feet of fresh air. The commissioners who investigated the state of the barracks some years since recommend but 1,200 cubic feet per hour for the rooms. The permanent regulations in the military service merely regard space per man, and allow the following:—In barracks 600, in huts 400, in home hospitals, 1,200, or in those on

foreign stations, 1,500 cubic feet. The French commission on the subject recommended 5,000 cubic feet per man in hospital during any epidemic, and in the Hotel Dieu, which is being rebuilt, 3,500 is counted upon. Allowance should be made for the abstraction of oxygen and addition of carbonic acid, which lighting agents produce, and calculations may be made on the datum, that one cubic foot of coal gas produces two cubic feet of carbonic acid, and will require thus about 1,800 cubic feet of air to dilute it down to a standard not injurious. An ordinary candle, six to the pound, will produce about an equal quantity of carbonic acid and much watery vapor. I may here mention that the unconsumed smoke of a smouldering candle is as hurtful as it is unpleasant, and a death has resulted from its poisonous effects. Some half-intoxicated fellows, for the purpose of teasing a boy who lay asleep in the corner of a room in which they were drinking, held a smoking candle under his nose for intervals during half-an-hour, when he became insensible, and he died with convulsions on the third day. Deaths have also resulted frequently from the gases evolved from burning substances—such as hay, if ignited by the practice of servants sleeping in lofts. Such effect of aërial poisons will not surprise us when we remember the immense surface which our lungs present (nearly twenty square feet) rapidly absorbing them ; and that re-breathed air is to be counted among such poisons will appear from the sickening and disgusting odour of the concentrated emanations from the lungs of several people : such will never be forgotten by any one who has had occasion to perceive it while arranging the outlet on the roof of a crowded building.

In approaching the subject of ventilation, I feel by no means confident that I shall not disappoint many of my hearers, for I shall be very brief, thinking that upon no subject has more been uselessly written and more inge-

nuity wasted. In saying this, I do not for a moment undervalue the advantages of fresh air, as will, indeed, be apparent from my preceding remarks; for, on the contrary, I look on all rooms, hospital wards, &c., as positively injurious to health unless the air in them be as inodorous as that of the free atmosphere about them. Although it is quite within the power of man, I do not, however, anticipate that the contrast between town air and country air, to which Milton alludes, will ever disappear:

> "As one who long in populous city pent,
> Where houses thick, and sewers annoy the air;
> Forth issuing on a summer's morn to breathe
> Among the pleasant villages and farms
> Adjoined, from each thing met conceives delight."

We have seen that Nature's provisions for the removal of foul air were among the most perfect and plainly beneficent of her wondrous works, so that in constructing means for the exit of air which has been breathed, we have but to endeavour to copy her. And the devices which animals instinctively adopt for the like purpose are equally interesting and instructive. Let us study, for instance, the operations of the bees to whom the work of ventilating the hive has been entrusted. The air can only enter at the door, as all the rest of the hive is plastered with propolis, a waxy matter with which the bees make their hives air-tight. There are gangs of from ten to twenty working bees each, according to the heat of the weather, stationed at the entrance, who ventilate the hive by vibrating their wings with great rapidity, and each gang is relieved when on duty about half-an-hour. If a greater need for air be excited, as when they are roused by shaking the hive, or letting into it some disagreeable vapour, the number of ventilators and the efforts of each are greatly augmented. The movements of the atmosphere which heat gives rise to, and the diffusive power of the air itself, tend to keep it constantly pure for the use of man.

The most appalling of all calamities due to ignorance of the want of fresh air—the suffocation of nearly 100 passengers on board the steamship *Londonderry*—which must be fresh in the recollection of many of my hearers, is the best and, to us, most interesting instance of the fatal effects of total want of ventilation I could detail. This vessel left Sligo for Liverpool on the 2nd of December, 1848, and stormy weather coming on, the captain forced 200 steerage passengers into their cabin, which was 18 feet by 11, and 7 feet high, thus allowing but 7 feet of cubic space for the breathing of each person. The captain now battened down the hatches, and lest a breath of air should enter, covered over the entrance with a tarpaulin nailed down. An indescribable scene of horror followed, and when the mate came to the cabin, 72 were already dead, and several others were expiring with fearful convulsions, and with blood starting from their nostrils, ears, and eyes. They were thus condemned to a death more horrible than if the ship had been submerged, through the captain's ignorance of the value of fresh air, which was separated from them but an inch or two. With a calamity so recent before the minds of ship captains, we would suppose no death from similar causes would ever again occur; but in a schooner lying along our quays during February, 1864, a sailor was smothered for want of ventilation in the forecastle. The black-hole of Calcutta, and the prison in which 260 out of 300 prisoners from Austerlitz rapidly died, are other well-known cases which it must be unnecessary to describe.

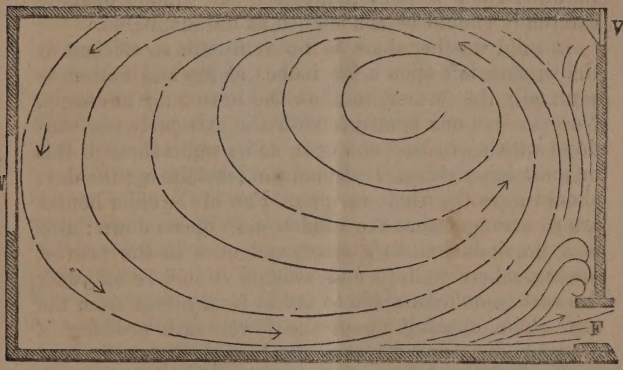
In contrast with such cases, remember the beneficial effects of ventilation in the saving of human life, as in the following instance. During the 25 years following 1758, when the Rotundo Lying-in Hospital was founded, 17,650 infants were born alive; 2,944 of them died, or about 1 in 6. The hospital, which up to this time was unventilated, was altered so as to allow a free supply of

air; and for the following 25 years but 550 out of 57,072 died, 1 in 104—a mortality 17 times less! The effects of impure air on horses can be more easily ascertained than upon men, because there is greater similarity of food and other circumstances among them. The mortality of the French cavalry horses was, up to 1836, 190 per 1,000 annually; improved ventilation of the stables reduced it to 68, of which more than half is by glanders. In our army, 20 per 1,000 is the average, and glanders is very rare, and is evidence of want of care.

The objects which we are to accomplish by ventilation are as follows:—To remove from our apartments all noxious gases produced by combustion, over-crowded respiration, imperfect sewerage, or by decomposing animal or vegetal matter, and to equalize their temperature and humidity. By ventilation there must be removed entirely, or at least diluted below an injurious degree, the 960 cubic inches of carbonic acid, and the two and a-half ounces of watery vapour and animal matter exhaled by each inmate every hour. This latter quantity is given off by the skin and lungs, and becomes increased considerably by the higher temperature which want of ventilation produces. The amount I have stated was estimated by Lavoisier's well-known experiment. He enclosed his body in an air-tight bag and breathed into another, and found that 11 grains were given off every minute from his skin, and 7 from his lungs at 60°. Under greater heat and more severe exertion a much greater quantity is exhaled.

If one reflected that in a close crowded assembly we are breathing over and over again the air which has passed through the lungs of many other persons, carrying from each noxious decomposing matter, that fastidiousness which makes us refuse the drinking-vessel which the lips of another has touched, would suggest to us the advantages of clean air.

The different density of cold and heated air produces a constant circulation in the atmosphere of any room, and unless the generation of carbonic acid be very rapid and abundant, as when the space is greatly over-crowded, it will be in this way pretty equally distributed. These currents which the heating of the air gives rise to in a room warmed by an open fire can be demonstrated by weighting a small gas-balloon, such as this, which costs only a few pence, until it is exactly of the same specific gravity as the air. When let loose it will move in the circles sketched in this diagram of a room with a ventilator, window, and open fireplace.



Currents in a heated room.

It will be remarked that the course of the balloon indicated that there was a current towards the chimney and the ventilator, and that an eddy was produced above the chimney-piece. These latter rapid movements can be best shown by the fumes produced by holding a sponge dipped in hydrochloric acid and held over a saucer filled with ammonia. In such an air-tight room of 424 cubic feet, by careful ventilation 44 cubic feet could be introduced per minute, or the whole air changed in less than

ten minutes, without any perceptible draught. The wind, or air in motion, is a most powerful ventilator, and in every room, for some part of the day, advantage should be taken of it. As it blows across the tops of our chimneys it encourages draught, and thus removes foul air.

Having explained a few of the principles on which exchange of air depends, I will bring under your notice a few methods of ventilation, *natural* and *artificial*.—Amongst the first rank windows, doors, fireplaces, and the permeable structures of which our walls, ceilings, and floors are constituted; and it may be at once asserted that any room without a fireplace and window opening externally should be condemned as uninhabitable.

In mild weather there is no ventilator so efficient as the window left open a few inches at top and bottom—especially the former, to allow the heated air to escape. Nevertheless one is struck with the extremely few windows which will be found open as he walks through this or most other cities. Bedrooms, at least during the day, should have the windows open. Few of the older houses are so arranged that the window-sash opens down; this is a grevious builder's error, and even in the poorest houses, where pulleys and weights cannot be afforded, the sash should be made to fall at least a foot from the top. The opening up of the lower sash produces a draught, does not disperse the heated air, and is dangerous for the children. In very cold and boisterous weather it is impossible to follow this advice about windows, unless some adjustment be made to prevent the external cold from acting too freely on the interior, and this can be accomplished by double sashes or panes, with about six inches of air intervening, which acts as a non-conductor of the low temperature. Strong draughts may be prevented from entering by having a louvred pane, with each slip acting on hinges, so that the amount of open spaces may be regulated. A piece of fine copper

gauze, about nine or twelve inches deep, fixed at the top of the window-frame, makes a good inlet; and that which is known as Cooke's ventilator, and for the sale of which the "Ventilation and Sanitary Improvements Company" was established, consists of copper gauze fitted to the top of the case, and bent at an angle of forty-five degrees. It may be so arranged by hinges along the angle that it will fold up when the window is shut, but it is less likely to go out of order if it be made stationary. The gauze finely divides the current of air, thereby preventing draught, and excludes the coarser mechanical impurities, as dust or insects. The object of the angular shape of the ventilator is that the upper half shall let out the heated air, and the lower admit the fresh; and I have found that there is a difference of about twenty degrees in the air which passes through each when a room is heated. Mr. Thomas Greer of this city has obtained a patent for a ventilator on a similar plan, save that it is stationary, semicircular in shape, and draught is prevented between the sashes by india-rubber pads. I may show you that gauze prevents draughts, by blowing through a tube against the flame of this candle, when you see it is scarcely affected if this piece of wire gauze intervenes. This model, which I exhibit to you, is one of Greer's ventilators fitted to a window. For small rooms perforated bricks, which sell for three pence each, inserted at the highest point of the outer wall, answer well, except in very stormy weather. The poor are so negligent about fresh air that they frequently paste paper over, or otherwise obstruct such inlets for that gift which alone can keep them healthy.

I am an advocate for leaving a small portion of the window of bedrooms open during the night, except in extremely cold or rough weather, and perhaps even then with the arrangements above alluded to, and always with a due regulation of the clothing. I know that during night less air is required, as carbonic acid is generated

much less freely, and that the body is particularly apt to chill; but I am averse to remaining in such air as your nose perceives when, in the morning, you enter an ill-ventilated bed-room. Moreover, in large manufacturing towns, the air is less polluted by smoke during night. There are some who object to regarding windows as ventilators on the score of their being constructed for another purpose; but so far from depreciating their usefulness in admitting light, I would urge that we do not enjoy the benefits of light as much as we should—for instance, not half as much as our French neighbors. Although in Dublin (perhaps the worse for us) we do not suffer, like Glasgow or Birmingham, from a murky atmosphere, yet the high houses overshadow the humbler ones, which are stuck here and there without regard to site or aspect; and the windows of the latter are so dirty as to act as efficient sunblinds. Light, besides its delightful cheerfulness, is useful in promoting the destruction by oxidation of organic matter in the air; and I believe that the cellar-grown man is blanched by the same unnatural want of light as is the underground plant. The limited window-space of English houses is one of the ill consequences of the tax which reflects no lustre on the otherwise brilliant name of William Pitt.

A fireplace is a good ventilator, especially when the fire is burning, as then it draws off several thousand cubic feet of air per hour. They are, however, made now so low that they merely ventilate the lower stratum of the air. Stoves are so numerous and various in pattern and design as to defy description in my limited space; but by the kindness of Mr. Bashford, of Ely-place, I am able to exhibit to you a specimen of every approved kind, and you can examine them at your leisure after lecture. The superiority of fireplaces or stoves in rooms over the hypocaust, or hot-flue system, was tested some years ago in St. Patrick's Hospital in this city, for the mortality was greatly reduced when

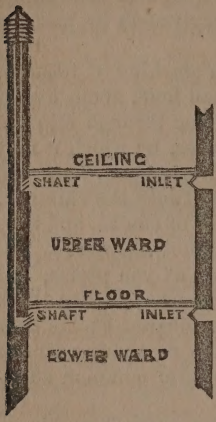
ordinary fireplaces were adopted with proper guards. It was the celebrated Benjamin Franklin who suggested the insertion of an aperture in the flue, near the ceiling, when describing his famous Pennsylvanian fireplace in 1744:

"In rooms where there is much smoking of tobacco, it is also convenient to have a small hole, about five or six inches square, cut near the ceiling through into the funnel; this hole must have a shutter, by which it may be closed or opened at pleasure. When open, there will be a strong draught of air through it into the chimney, which will presently carry off a cloud of smoke, and keep the room clear; if the room be too hot likewise, it will carry off as much of the warm air as you please, and then you may stop it entirely or in part, as you think fit. By this means it is that the tobacco smoke does not descend among the heads of the company near the fire, as it must do before it can get into common chimneys."

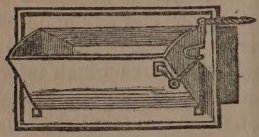
Doors are ventilators, as you can prove by taking a candle in a close, heated room; if you place it at the chink above, the flame will be blown outwards by the hot air escaping; at the bottom, inwards by colder air entering. The air, however, so admitted may not be the freshest, having been used below stairs and afterwards sent upwards by its being heated. You will be surprised to hear that even through bricks much interchange of gases takes place; and the unwholesomeness of closely-jointed iron houses has been assigned to the difference. Ceilings of old houses often show that there occurs through them a passage of air carrying dust with it, and under the large wooden rafters, where no such passage occurs, the colour is lighter, dust not being fixed into the plaster.

Of artificial systems of ventilation I shall mention but few, as I can refer you to Prof. Parkes' admirable treatise, where every plan of value is described. That which

Miss Nightingale most strongly recommends for hospitals, consists in shafts built in the walls, and opening near the ceiling of the room, the opening being louvred to prevent any down-draughts; and a turret projects from the roof so as to carry off the foul air. In an opening in the opposite wall should be fixed one of these, Sherringham's Inlets, which, having one side hinged, can be arranged to let in any quantity of fresh air.—This simple plan is here depicted. The sectional area of the shaft or air-drain should be in proportion to the size of the room, and one inch for each 50 cubic feet on the top floors, and 60 on the lower would suffice. The size of inlet or outlet in barracks was fixed by the Commissioners of 1861 at eleven square inches for each inmate, but remembering the expansion of heated air, the outlet might be a little larger. Fresh air might be introduced from a space below the floor of hospital wards, and admitted into them by fine wire gauze set near the beds.



Section of Ventilated Ward.



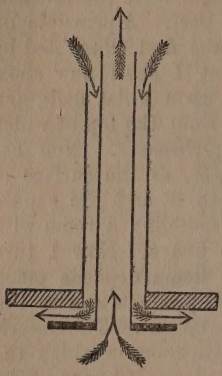
Sherringham's Ventilating Inlet.

The late Dr. Reid advised that air for buildings should be taken from a height, as it would be purer; and this was done at Guy's Hospital, where a shaft ninety-five feet high is erected, and at the bottom of it the air is warmed by means of hot water. Such air would be free from sewage gases. Of ventilating roofs

or ceilings, one of the most beautiful is that of the Alhambra at Granada, into which there are set several exit tubes of most graceful shape. In public edifices the roof, if somewhat conical, should have the ventilating outlet inserted at the highest part. A principle on which many ventilators depend was first illustrated by Prof. Daniell with the experiment I shall now show you. I place this lighted taper upon a flat dish, and place over it this glass receiver, from the top of which extends a common glass lamp-chimney. You see that air enters under the receiver, as the surface of the dish is not perfectly fitted to it, and the candle burns away—the arrangement resembling a room with air admitted below and an outlet above. Now I turn the vessel to one side, and the flame deposits much soot on the side, and the unburned products causes the flame to get dim, and it will finally go out. The experiment now shows the condition of a room in which the outlet does not occupy the highest place. If I pour a little water into the dish, so as to prevent the entrance of any air below, the candle, you will find, will become extinguished as the efforts of the hot air to ascend, and the fresh to descend, through the chimney will mutually counteract each other; and this state of things resembles a room ventilated only at one point. Now, I will divide the chimney into two by a slip of tin, and then the hot and cold air will each select a passage, and the taper will burn brightly on. This bit of smouldering paper, held above the tube, will show by its smoke being forced upwards, that the hot air is ascending through this half; and now by its being drawn inwards that the fresh air is rushing down in this. Watson's, Mackinnell's, and Muir's ventilators are applications of the principle; but as our experiment shows, they cease to act when by an open door or window the air is admitted below.

As an instance of the efficacy of such tubes as Mackinnell's, which is represented in the next woodcut, I may

mention that by them the Chapel Royal, St. James', during the marriage of the Princess Royal, though filled with 1,500 people, was thoroughly ventilated, and kept at a temperature of 58° for five hours. They would be very suitable ventilators for railway carriages, which are wretchedly close and unwholesome—as one perceives especially on entering at a midway station. The ventilator, as in the American cars, should be at the summit, and should be permanent—not subject to the whims of obstinate people, who are ignorant of the advantages of fresh air.



Mackinnell's Ventilator.

Small tubes carried from the ceiling of each room in a building, and opening into a larger pipe conducted to kitchen flue, or any larger flue which may be near, are most effectual in ventilating. A building, not inaptly called the "Barracks," in Glasgow, containing about 500 of the poorest lodgers, was so infested with typhus that 57 cases occurred in the two months before it was ventilated. Such a system of tubes as I have alluded to was adopted, and but four cases of fever occurred in the eight succeeding years.

In the Exhibition Palace concert hall there is an admirable ventilation by means of the gasaliers in the ceiling, the air from around them being rarified by the heat, and thence conducted by shafts to the roof. Such a system is most suitable for places of worship and public resort, in which our physical health is at present too often jeopardized.

All artificial ventilating apparatus will fail if worked by hand, for workmen, not realizing the danger of aërial

poisons, will neglect them. In factories, however, where steam power can be applied, some means of producing free currents, like Fairbairn and Lillies' four-guinea fan, does immeasurable good. Its effects were illustrated in a mill near Manchester in an unexpected way—namely, by the men asking higher wages, their appetites having increased with the use of pure air. In soap-boiling houses and such places, where fetid animal vapours are emitted, the foul air should be made to pass through and feed the fires, as first devised by Sutton.

The introduction of fresh air, the expulsion of foul, the heating in winter, and cooling in summer of the Houses of Parliament, are now achieved by the following means, devised partly by Dr. Reid, Mr. Gurney, and Dr. Percy. The fresh air, filtered of suspended particles by screens as it enters from the courts, is heated by passing over iron chambers filled with steam, under the floors in the mixing spaces, and then ascends through perforations in the floor, which are covered with horse-hair cloth to prevent a perceptible stream. In summer the air is cooled by wet cloths being placed about the iron chambers, and by spray jets, which by producing abundant evaporation, cool it, supply the proper degree of watery vapour, and free it from much of the putrefactive odour derived from the river during very hot weather. The foul air escapes through the roof, and is thence conducted to an enormous coke fire and chimney in the Victoria Tower. In 1858, however, the stench from the Thames became so great, that canvas wet with chlorides had to be fixed to the windows; and this failing, the air had to be obtained from the level of the belfry, 200 feet high, and then passed through a large room containing fresh-burnt charcoal, which has such a wonderful power of absorbing gas and, by its powerful oxidizing property, the effect of checking putrefaction of organic matter. It is now remarked that any odour, such as that of roast meat, is most rapidly wafted

from the court-yard through the whole ventilating system to the House.

Methods of ventilation by propulsion of the air into the building have had many advocates, and one of them has been adopted in that splendid building, St. George's-hall, Liverpool, where, however, the most enthusiastic admirer of fresh air must admit that ventilation is excessive occasionally. A gentleman who dined there some time ago on the occasion of some public festival, informed me that the table-cloth was with difficulty kept on the table, and few escaped without colds or tooth-aches.

The ventilation of coal mines is now managed by a large aspirating shaft, and has been so perfected in some districts that the health of the miners is most perceptibly improved. Surely, every effort ought to be made to make the wretched life of the collier more endurable; the dangers of descent and of poisonous gases, and the darkness and dust, are sufficiently dreadful. In copper and lead mines most injurious effects are still produced; for as there is no danger to life or property by such explosive gases as those which are generated in coal mines, the proprietors are unfortunately more negligent in adopting means of ventilation.

All the modes of renewing the air we have alluded to depend on making a partial vacuum; but a plan which may in contradistinction be called the "plenum method," and which first occurred to the wonderful mind of Robert Boyle, may be mentioned. It proposes to condense by pressure the air in the room, and it was said to increase the facility of breathing, and to introduce more oxygen than in ordinary breathing, even to the reddening of venous blood, and thus to exhilarate all the functions. Like many other queer ideas, it has attracted the greedy charlatan, and an establishment in Yorkshire—Ben Rhydding I think the place is called—has been got up for the cure of many diseases. I must in candour state that the late Dr. Hunt, formerly one of my most intelli-

gent pupils, was a firm believer in this compressed air for pulmonary symptoms, under which he laboured.

The last plan I shall allude to is that described and figured by the Commissioners on the Warming and Ventilating of Buildings, and also in Tomlinson's most excellent manual on the same subjects. The fireplaces are directed to be arranged back to back in a partition wall. The chimney should be made of vitrified clay-pipes about ten inches in diameter, and outside this there should be another space into which open apertures from near the ceiling of each room, to let out the foul air. Air to feed the fires is to be admitted from without through air bricks, and carried along the floor to below each fire. This plan may appear complicated and expensive, but it will not be really so if arranged during the building of the house.

All means for ventilating public buildings, will, however, be abortive if over-crowding be not prevented, especially of those who are inattentive to habits of personal cleanliness. There are few situations more insufferable from closeness than a dense crowd, even if in the open air, and, as an engineer once remarked to me when discussing the ventilation of a building which was referred to us, "it wouldn't be fully ventilated, even if the roof were taken off, if it be crammed with the 'great unwashed.'" As an instance of the accurate information on hygiene which military officers must possess, I will quote Dr. Parkes' rules for the estimation of the ventilation of rooms, and the time will come when civil officers will have to be as exact.

"The ventilation of a certain room being about to be examined, enter it after being at least fifteen minutes in the open air, and notice if there is any smell. Measure the cubic space, then consider the possible sources of entrance and exit of air; if there are only doors and windows, notice the distance between them, how they open, on what external place they open, whether there

is free passage of air from side to side, whether it is likely the air will be properly distributed. On all these points an opinion is soon arrived at. If there are other openings, measure them all carefully, so as to get their superficies; the chimney must be measured at its throat or smallest part. Determine then the direction of movement of air through these openings by smoke, noting the apparent rapidity. The doors and windows should be closed. When the inlets have been discovered, consider whether the air is drawn from a pure external source, and whether there is proper distribution in the room. Then measure the amount of movement in the outlets with an anemometer, or calculate by the table if it seems safe to do so. If the ventilation of the room is influenced by the wind, the horizontal movement of the external air should be determined by Robinson's anemometer, which is now supplied to many military stations. Then proceed to the microscopical and chemical examination, if this is considered desirable, as it will frequently be."

Until legal enactments were passed to compel the smoke of factories to be consumed, the atmosphere of London and many manufacturing towns could not be said to be transparent, owing to the soot with which it was charged. There is now, however, the greatest improvement in this respect by more careful stoking and apparatus for consuming the unburnt smoke. It was calculated some years ago that the London people had to spend annually two and a-half millions more for washing than an equal number of country families. Such improvements—which I told you in my last lecture the Corporation was determined to enforce—will also lead to freer ventilation, for it used to be objected to windows opened, that they deluged the rooms with smuts. The cheap and simple ventilators which I have often urged should be inserted into the outer wall of every room occupied by the poor—namely, plates of finely perforated

zinc near the ceiling, would have the additional advantage of shutting out much smut or dust. The rooms of the poor—which are so close that it is not safe for the physician to enter unless the windows are previously opened—of all places, should be thoroughly aired daily; as the old furniture—including those articles which should be banished from every house, namely, bed-curtains—are soaked with organic matter. It is a popular delusion that ventilation means cooling, whereas many of the plans I have very briefly sketched contemplate the airing and warming of our buildings at the same time. During exercise, and with proper clothing, the temperature of our bodies, 100°, is exactly maintained by the generation of heat within the body; but while at rest, artificial heat is demanded, at least during winter in cold climates. This is especially the case with infants, old persons, and invalids, in whom the spontaneous production of heat is not active. The best means of affording it is by radiation, such as from Count Rumford's store, or the innumerable varieties which have been produced out of it; but in large rooms one source of radiation will not suffice, as the effects decrease according to the square of the distance. Then several fires or stores may be used, or some of the methods of conducting heat by hot air, water, and steam pipes or metal plates, may be adopted. The most ingenious plan is that patented by Perkin, in which strong pipes of half-inch bore circulate freely through the room, and pass through a fire—the temperature of the water in them being thus raised above 300°. The air in rooms heated by most of these methods has a peculiar smell, and a dryness which is hurtful in many pulmonary cases. In prisons and some other public buildings such systems are indispensable. A system of ventilation and warming has just been arranged in the council-room of the Dublin Corporation. There are circulating four-inch pipes under each of the benches, communicating with a boiler and

with a cistern, which secures a constant supply. There are also two fireplaces. Air is admitted under the floor, divided by gauze, and heated by the hot water pipes. The foul air escapes by outlets at the edge of the ceiling, and by two glass domes which are raised upon gauze supports. This building usually contains from 60 to 200 persons for a meeting of some three hours duration. The expense of the warming and ventilating plan has been about £100.

I will now direct your attention to some diseases which we have reason to believe are producible by a want of constantly renewed fresh air; and I regret to say that it is in the records of hospitals some years back we shall find the most plentiful evidence. Some diseases have even had the term "hospital" prefixed to them to indicate their dependence on the atmosphere in which they arise, and which has itself been distinguished as "nosocomial air." I shall afterwards allude to the difficulties which surround the proper ventilation of hospitals, mainly arising from the fact that many of them, having been originally constructed for private dwellings, become over-crowded when adapted to a purpose for which they were quite unsuited, and from the conflicting wishes of patients, differing as much in their feelings regarding foul or fresh air as in the nature of their diseases. Hospital patients usually dread fresh air as being cold-giving forgetting that it is possible to warm it and break its flow in such a way as to produce no discomfort, much less illness. Restlessness, *malaise*, the slow healing of sores, and tedious convalescence, have been frequent ill effects of close hospital air, while such horrors as contagious gangrene, erysipelas, and a fearful blood-poisoning we surgeons call pyæmia, positively killed more patients in the hospitals of the eighteenth century than the very advanced surgical skill of their attendants cured. On the curative effects of pure air upon the usually fatal disease which I have last men-

tioned, hear the opinion of Mr. Paget, perhaps the most scientific surgeon living: "Of all the remedies I have used, or seen in use, I can find but one thing that I can call remedial for the whole disease pyæmia, and that is a profuse supply of fresh air. In the three most remarkable recoveries I have seen, the patients might be said to have lain day and night in the wind—wind blowing all about their rooms." The contagion of hospital gangrene adheres so closely to the wards, that the walls of the New York Hospital had to be taken down as a last resource before the disease was eradicated. Air is plentifully required in hospital wards to oxidize the abundant organic matter which is so freely emitted from the bodies of the sick; and if they smell foul when one enters for a moment, what injurious effects must the patients suffer who are confined within them for the whole twenty-four hours? The frequent fever of charitable institutions some years ago was mainly promoted, if not produced, by want of air and space, as was indeed confessed by the name it commonly bore—"the sickness of the house."

One of the first medical writers who drew attention to the influence of a want of ventilation in producing scrofulous diseases, including consumption, was our own great Carmichael, who, in 1809, clearly proved that 7 out of 24 of the children of St. Thomas's School, and 6 out of 30 of those in the Bethesda, were affected in consequence of want of exercise and of freely admitted air. The children's wards of the House of Industry were that time so much over-crowded and so ill-ventilated, that "there was no enduring the air when the doors were first thrown open in the morning," the cubic space to each inmate being under 120 feet. I have visited many schools and boys' homes in which the air was foul and disease-producing, and in one of the latter institutions, during the recent outbreak of cholera, its unhealthiness became notorious. Although very much

has been since then written upon the causation of consumption by impure air, there is ample room for searching investigations upon the subject, entered upon with no preconceived impression. For instance, a full inquiry into the hygienic conditions of the people of the Island of Lewis, west of Scotland, who enjoy so great an immunity that deaths by consumption occur but at the rate of 16 per 100,000, and of the denizens of crowded parts of London, where they are thirty times more numerous, should lead to conclusive and most salutary results. It has been fully established that domesticated animals are much more subject to consumption than those in a wild state; the main difference between these two conditions being the want of free ventilation and exercise of the breathing function to the full extent. Rabbits, the monkey, sheep, and most other animals, can be rendered artificially consumptive by confining them in close and dark places, and without doubt human life is daily being sacrificed by the same experiment unwittingly made.

Exposure to air containing mechanical particles produced by certain employments—as needle-grinders, earthenware-makers, stone-masons, bakers, flax-dressers, and cotton-carders—frequently excites this disease, which, amongst some of these trades, is known as "grinders' rot." The miners of England number some 300,000, and except in the coal-mines of Durham and Northumberland, where ventilation is perfect, they die early from pulmonary complaints. The deaths by consumption in the army have been alarmingly numerous, but I feel no doubt they will diminish with improved air space insisted on in barracks by the late Commissioners. The ventilation of ships is certainly difficult, and the great prevalence of consumption amongst seamen of the navy and merchant service some years ago was attributable to its imperfection. Dr. Guy, after a most masterly investigation of the circumstances influencing the health

of printers, clearly demonstrated that their proclivity to consumption was due to want of ventilation, and among compositors to want of exercise in addition, for they were one-fourth more subject to it than the press-workers. The most enthusiastic support to the argument that foul air is productive of, and pure air preventive of consumption, will be found in the well-known writings of Dr. MacCormack. Sea air is that which is certainly the most powerfully preventive, but with unsanitary habits, the disease is often as frequent at sea-side places—as we were informed very long ago by Smollett, that authority even on matters medical, for in travelling through Boulogne, he found scrofula, including rickets, very prevalent, and attributed the fact to the putrid vapours in the lower part of the town—which to my nose, while walking through its streets, during the summer of 1863, smelt even worse than the ill-famed ones of Cologne.

The question of the origin of typhus, and the spread of this and other contagious diseases through an insufficiency of pure air, will be perhaps more appropriately considered on a future occasion; but here I must state the advantages of free ventilation during the treatment of this fever, so frequent in our land—1st, the comfort and more rapid recovery of the patient; 2nd, the removal of danger to the attendants; and lastly, the prevention of the spread of the contagion by its lurking in the furniture of the apartment or clothes of the patient or attendants. Consumption is, I am sure, induced, and contagious diseases spread, by the over-crowded and ill-ventilated state of the rooms in which large numbers of tradesmen, tailors especially, work together. Alcoholic stimulants are made necessary by the depressing effects of the foul air, and much of the intemperance of the artizan class has its origin in this way. If these rooms are lit by gas, as they generally are, the ventilation should be most perfect, for it has been found that an

ordinary burner consumes about five times as much oxygen as one man.

In introducing the subject of aëriform poisons to your notice, it is important that I should explain some terms by which they are often designated.

Malaria is an Italian word signifying "bad air," and miasm, from the Greek, is often used as a synonymous term; but carbonic acid or chlorine diffused through the air would come within the definition founded on these terms. I shall, therefore, speak of each agent by the name of the disease which it produces, and if any epithet be needed to group together ague-poison, typhus-poison, small-pox poison, and the like, let it be the word "aëriform." Of the first, I will speak especially here, leaving for another lecture the poisons generated by the human body, for they reproduce themselves, and are therefore *communicable* from one individual to another. Ague-poison does not present these features, but is endemic and locally atmospheric. The firmest fact concerning the ague-poison is, that it is connected with the decay of vegetal matter; and that the aëriform bodies so evolved are brought down again to the earth's surface by the dew, is one of the most favourite theories founded on this assumption. Another fact we may rely on is, that heat is one of the most powerful extrinsic agents, for it favours organic chemical change, and raises the moisture from the earth's surface which spreads the poison. It has been calculated that marsh poison may diffuse to between 1,400 and 1,600 feet vertically, and about 800 feet along the surface, and the air be still; but winds will convey it much farther. Trees are supposed to act as a barrier to its spread, either by offering mechanical obstruction or by decomposing the gases it contains. Chemical examination of the air about marshes promises much towards discovering the ague-poison, but as yet it must be acknowledged that the analyses we possess do not determine the point. The gas most constantly and

abundantly present is light carburetted hydrogen, and next in importance to this a slight excess of carbonic acid. Sulphuretted hydrogen may be found owing to the decomposition of sulphates by organic matter, especially if the marsh be so situated that the sea can be washed over it. The celebrated Prof. Daniell, finding much of this gas in water obtained off the west coast of Africa, believed he had discovered the cause of yellow fever, which was some years ago so fatal there. Organic matter to the amount of 8 grains to the 1,000 cubic feet has been obtained from the atmosphere of marshes, and it is a suggestive fact that it has exactly the same chemical character as the organic matter exhaled from our lungs, turning red with nitrate of silver, yielding ammonia when heated with lime, and blackening sulphuric acid when drawn through it. Chlorine, and not ozone, destroys this matter, which some regard as the ague-poison. The only plausible grounds that a disease may arise from the entrance of minute animals from the atmosphere into the animal body, is the statement of a recent French writer that splenic apoplexy, or braxy in the sheep, is due to species of bacteria which, floating in the air, enters the creatures lungs and thence its blood. He has inoculated animals with the disease by the blood of those affected. This animal of the air is not destroyed by oil of vitriol, but a heat of 212° kills it. I have no doubt but that, amongst all kinds of suppositions, the theory that the evil of malarious air is the negative one of a deficiency of oxygen, has been advanced; and the constant concurrence of organic matter which in decomposing so greedily abstracts that gas, the frequent concurrence of a ferruginous soil which might absorb it, and some of the peculiar symptoms of ague, certainly support the notion, if one so hypothetical be allowed for a moment. Marshy air, like other ills, has been saddled with deaths which do not fairly belong to it; thus, as Dr. Hunter lately demonstrated to the Privy Council, the

awful infant mortality in the fenny districts of Lincolnshire was due to the neglect, drugging, and famishing which the poor innocents were subjected to, their mothers being all day at out-door work. Ague was a frequent disease in Great Britain up to the beginning of the present century, and its almost entire disappearance is due to improved and extended drainage. Perhaps we can explain our immunity from ague in this country, where moisture and organic matter are found plentifully together in our bogs, by the great astringency of the water acting as a preservative; the same character of the water of bogs fortunately makes them an undesirable residence for toads and serpents.

The striking salubrity of large level spaces, such as commons or flat extensive strands, like that of Tramore, will be perhaps more appropriately submitted to you when I come to speak of climate; and on Saturday, when I trust to have again the pleasure of addressing you, I will offer for your consideration the subject of water, which, next to air, is most essential to life and health.

LECTURE IV.

WATER—ITS IMPURITIES, AND DISEASES PRODUCED BY THEM—METHODS FOR THEIR REMOVAL—THE DUBLIN WATERWORKS.

Before discussing the hygienic questions connected with water, it may seem unnecessary that I should allude to the physical characters of that fluid; but they are so full of interest, and play so important a part in Nature's great and wondrous cycle, that I cannot avoid recalling to your recollection some such facts.

Water when pure is inodorous, tasteless, and colourless, save in large masses, when its normal tint seems a blue—for instance, in the Grotto Azzura, in the Bay of Naples, where it is, moreover, so transparent that small objects can be seen several hundred feet from the surface. Other shades, as the brown of our bog rivers or the blackness of that of the Rio Nigro, are always due to organic impurity. Below 32° water is solid; liquid from this temperature to 212°, when it assumes the gaseous form freely, but at all temperatures some vapour is emitted. By, however, avoiding agitation, and very gradually lowering the temperature, water may be brought to 5° without freezing. Unlike other bodies, which contract or become more dense when changing from the liquid to the solid state, water expands, and decreases in specific gravity from 1,000, at which it forms the standard for all other bodies, to ·916 when converted into ice. The sheets of ice which form on our lakes and rivers remain on the surface owing to this fact; and if they did otherwise, the layers would accumulate, and not only should aquatic animals cease to live, but, by the abstraction of heat, terrestrial life would also perish.—This variance from other bodies is thus most providential.

When we assign 212° as the boiling point, we mean that such is the degree at the sea level; but as we ascend, the barometric pressure, and therefore the boiling point, proportionally lowers; and the fact has been used in ascertaining the height of mountains.

The power of absorbing heat, which water so pre-eminently possesses, gives rise to benefits of vast magnitude; for instance, the vapor is thus raised in countries of high temperature, and then distributed in cold and dry regions to moderate their rigorous and arid climates; and again, in our own bodies, water abstracts heat from the parched surfaces, and when it afterwards evaporates, it produces further coolness. But there are many other functions which it performs in the human body—it renders fluid and capable of circulation all the nutriment of the tissues, acts as the great solvent for removing waste matter, and permits that exchange of materials through the membranes which constitutes the process of nutrition and secretion, by which our bodies are built up and their waste matter removed. Nearly four pounds of water as such, in aqueous drinks, or contained in solid food—and the more nutritious the latter is, the more thirsty it makes us—are daily introduced into each human body, and leaving it again by the skin, the lungs, the kidneys, and the bowels, exercise the cooling and cleansing powers of that fluid. It forms about three-fourths of the weight of the body; but, indeed, Blumenbach possessed a mummy which, when thoroughly dried, weighed but seven and a-half pounds. I have seen the fact rather smartly described as follows: "Incredible as it may seem, a muscular Life Guardsman is little better than a pumpkin—he is only another form of a water melon after all; if he were put into an hydraulic press he would be able to sink into his shoes with the greatest ease." The amount of water which analysis reveals in each part is proportional to the quantity of blood it receives, and its consequent activity of function; and in all these re-

spects the brain and the scarf skin, which respectively contain 789 and 37 parts per 1,000, are most strongly in contrast. Such essential qualities in human structures as pliancy, toughness, and elasticity, would be absent if water did not abundantly exist in them.

All water is originally derived from the sea, and being raised from this never-failing source as vapor, returns to the earth as rain, and thus supplies our rivers, lakes, or springs. In percolating through the soil, much of the organic and gaseous impurity of rain-water is oxidized, and therefore spring-water issuing from depths is most pure and wholesome, unless passage through limestone has rendered it too hard. The oxygen which exists so abundantly in the soil serves also the purpose of destroying organic matter, for otherwise the neighbourhood of towns would become intolerable from the soakage of refuse into it.

Rain-water abounds in gases, such as air—which is peculiar in containing about 35 per cent. of oygen, and carbonic acid to the amount of $2\frac{1}{2}$ per cent. of the whole gases—and in such substances as nitric acid, its salt with ammonia, sulphuric acid, and carbon (if it falls in cities, and is collected after having washed over dusty roofs and gutters), chlorides near the sea, and in some situations, as Paris, iodine has been detected in it. Its solids per gallon average $2\frac{1}{2}$ grains, of which nearly half a grain is organic. From its mawkish taste, and the uncertainty of its supply, it is not generally used for drinking; but its comparative purity has been said to check the frequency of diarrhœa and cholera when used for this purpose. Its softness, or freedom from limesalts, makes it a favourite with the laundress. In arid countries good water has been obtained by exposing woollen cloths to the dew and wringing them out.

River, spring, and well water vary much with the geological character of the district they come from, and, in the case of wells, with the depth to which they are

sunk; thus, no two waters can be more different than that of a shallow well of some twenty feet, and that from a Paris artesian well 1,800 feet deep. The latter water is usually alkaline—for example, that from a well in Southampton 1,360 feet deep contains eighteen grains of carbonate of soda per gallon. River water has usually a moderate amount of gases dissolved in it—for instance, about seven cubic inches of carbonic acid per gallon, but they are considerably reduced by exposure. Another mechanical means—filtration—removes abundant suspended impurities of such heterogeneity as clay and sand, infusoria, muscle fibres, biliary and sewage matters, algæ, confervæ, and fragments of wood, which substances average, for instance, in the water of the Rhine, eight grains per gallon; and in one year the Ganges deposits enough matter to cover 172 square miles a foot thick. The agitation and exposure to air and to plants which river water is exposed to will eventually purify it. Thus, last autumn the Mississippi, which received all the sewage of Cincinnati when cholera was raging there, supplied good water to Louisville, 300 miles lower down, and that disease did not appear for months after. The salts are usually those of carbonic, sulphuric, nitric, and phosphoric acids, and chlorine, with lime and soda; and these, together with the dissolved organic matter, escape the filter, and are important impurities, notwithstanding the bright and sparkling character of such water. Even thirty grains per gallon of organic matter may be contained in water, and may not apparently hurt those who are habituated to it, except under predisposing states of the atmosphere; then it may suddenly become injurious. As an example of objects which the microscope discovers in filtered water, I may show those from the water of the Grand Canal, which is supplied to Rathmines Township. Some of these living forms were developed subsequent to the filtration at the source.

It must not be supposed, because of the circular shape of the figures in many books on the subject, that all the plants and animals which are depicted are contained in a single drop of water; the portion the minute objects I have shown you were obtained from, was that allowed to settle in a large conical vessel, and the sediment was then placed in the field of the microscope. It is probably a fallacy to regard these little beings as the source of danger in impure water; on the contrary, they are scavengers for removing the organic decomposing matter which their presence indicates. As models of purity in drinking water may be instanced that of the Loka in Sweden, which, flowing over granite, contains but $\frac{1}{10}$ of a grain of impurity per gallon; that of Loch Katrine, now supplied to Glasgow, which has but $2\frac{1}{2}$; and that of the Vartry which we will soon enjoy, and in which but 4 grains per gallon exist. On the other hand, superficial pumps produce in large cities the most impure of natural waters; for instance, the water of one in Liverpool contains 417 grains per gallon of solids; and that of Park Crescent, London, which attains the height of filthiness, had, according to that accurate analyst, the late Dr. Dundas Thomson, 43 grains per gallon of organic matter, chiefly derived from sewage. Among other matters of animal origin may be mentioned butyrate of lime, of which 105 grains per gallon were discovered in a well fouled by a drain, into which this fatty matter must have somehow entered.

The vegetal matter in river water is chiefly humic acid, and the animal products which are highly nitrogenous and abound in butyric acid, are derived from dead animals and manure and sewage, which soak into the river in highly-cultivated districts or dense populations, especially after heavy rain. The steeping of flax in rivers, or waters flowing into them, is likely to add much organic impurity, and early in the 17th century was prohibited by royal edict in Flanders. Another source of

impurity in shallow well-water of cities, is gas refuse from the works, or the gas itself escaping from leaky pipes and impregnating the earth. Even the most impure well waters may be sparkling and cool, and for these reasons have been often reckoned wholesome—a grievous error, as we shall see hereafter.

The characters of a good drinking water may be enumerated as follows—1. The temperature should be about 10° less than the surrounding air, and not less than 50° below that of the human body. 2. Freedom from taste, except its naturally saline one, and slight pungency from carbonic acid and air, which appear to render it more readily absorbed. It must be remembered that matters most deleterious may escape the watchfulness of this sense; 70 grains of common salt per gallon give no perceptible taste. 3. Absence of smell. 4. Transparency and absence of colour, which latter character, however, is not essential; for instance, many waters in this country are brownish from peat, but not necessarily unwholesome; and on the other hand, water charged with sewage products is often bright and colourless, though most deadly. The colour is best tested in a large mass of water, as by looking down through a glass tube some feet long, with a bit of white porcelain at the bottom, as devised by Letheby—and Mr. Tichborne of this city has improved on this simple plan. 5. Alkalinity, which is usually from carbonate of lime; and 6. A moderate amount of dissolved solids. The Brussels Sanitary Congress fixed the maximum quantity of solid matter which potable water might contain at 35 grains per gallon, of which not more than a grain should be organic. This is a standard by which, however, we should not be guided, for few, if any of the waters supplied to towns approach this total amount of solids, and some of our best have nearly double the quantity of organic matter assigned. The amount of lime salts is often indicated by the difficulty of cooking peas or other vegetables in some waters.

I may mention the amount of saline matter which sea water contains—namely, about 2,500 grains per gallon; but great variety occurs, even to such an extent that 40,000 grains per gallon have been found in the water of a small lake east of the Wolga, owing to enormous evaporation and the rare addition of pure water. In river water the lime-salts are always the most abundant, and are derived from limestone, over which it flows, giving up some of its substance to the carbonic acid in the water. When such water is boiled, the carbonic acid is driven off, and the lime-salts are deposited on the insides of the kettles and boilers in crusts, which often become fœtid from decomposition of the organic matter mixed with them, and should be removed. Some mineral waters—for instance, that of Schwalheim—contains as much as $2\frac{1}{2}$ parts by weight of carbonic acid per 1,000; they therefore effervesce as they issue from the earth. The presence of arsenic in some river waters and springs is a significant fact; $\frac{1}{250}$ of a grain per gallon exists in that of the Mersey, and $\frac{1}{150}$ in that of the Weisbaden mineral water. The well-known high temperature of this water, and its greasy appearance and taste (very like that of weak chicken broth), make it indeed a surprising natural object.

The advantages of a soft water are, briefly, that it is more economical, by the saving of water and soap in ablution and washing of clothes, and it saves fuel by boiling at a lower temperature, and by forming no crust, which must weaken the heating power of the fire. Much labour is required for removing this incrustation. Soft water is more suited for most culinary purposes—for instance, the making of tea.

In order to fix on your memories the usual impurities of water, I will add to each of these vessels of pipe-water from the South Basin a re-agent which will detect the presence of some substance, certainly injurious if in excess—1. Carbonic acid is shown by whiteness on

adding baryta water. 2. Sulphuretted hydrogen (which I have introduced by adding a drop of this sewage water), by giving a brown or black colour with acetate of lead. 3. Sulphuric acid, by chloride of barium producing a whiteness. 4. Chlorides, by nitrate of silver giving a white muddiness. 5. Lime, shown by whiteness on adding oxalate of ammonia. 6. Nitric acid, which sewage or graveyard pollution will introduce, by evaporating to a small bulk, adding a little sulphuric acid, and then a drop of solution of indigo in sulphuric acid—on heating, the blue color will disappear if nitric acid is present. 7. Organic matter, by the decolorization of solutions of permanganate of potash, and several of the metals might be shown to be present occasionally by the tints they give with sulphuretted hydrogen.

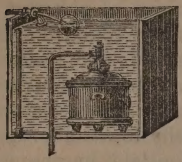
The purification of water before it is offered for human consumption is a subject of the very highest importance, and yet one which in many communities meets very little attention practically. Some useful changes occur spontaneously in water, such as the settling down of a sediment of several suspended impurities, and the discharge of sulphuretted hydrogen, and for this purpose the water on the West Coast of Africa is exposed in small quantities, or is made to flow in divided currents, before being supplied to our troops. On board ship filthy water will certainly clear, but the dissolved organic matter makes it most dangerous. Every care should therefore be taken to procure a proper supply. Organic matter is chiefly to be removed by filtration through charcoal, exposure—which promotes its oxidation—by boiling, by the addition of such oxidizing agents as permanganate of potash, or of astringents such as alum or tannin, the former of which is open to the objection of adding to the sulphate by decomposing the carbonate of lime, but it has the advantage of throwing down all finely suspended particles of clay. Astringents of all kind precipitate the coagulable albuminous matters, and in this

way the strychnos potatorum, or "clearing nut," acts when rubbed upon the vessels in which water is kept in many parts of India. For similar purposes chips of oak are thrown into the drinking water in the country round Bordeaux. Compare these facts with what we read in the Book of Exodus, when Moses used the bark of a tree to render the waters of Mara sweet. The Chinese can scarcely drink the impure water which their filthy towns afford, but prefer to take weak tea as their constant beverage instead.

Filtration through sandstone, or various mixtures of sand and gravel, can only remove the coarse mechanical impurities, and therefore but little reliance is to be placed upon it if the original supply has been impure. Such filter-beds are expensive also, as they require frequent renewal; thus, it has cost the 50,000 people of Toulouse £40,000 within a few years for such changes in the filtering apparatus through which the Garonne water is passed. For domestic purposes, water may be freed from mechanical impurity by this little piece of French sandstone, to which is attached a flexible tube, or by charcoal arranged in a similar way, and which is small enough to carry in the pocket.

Finely-powdered animal charcoal, or bone-black (and that from peat is nearly as efficacious), tightly pressed down and frequently changed, is the most reliable medium for filtering water on the small scale, as it will purify 600 times its weight of water—that is, 1lb. to 60 gallons of water; but it must be always borne in mind no kind or amount of filtration will ever render impure water quite pure or even safe for drinking. This is unfortunately too true from Dr. Frankland's experiments, made on the 10th of November, 1866, for he found that the rice-water cholera-stuff, passed through filtering paper and animal charcoal, unchanged as far as we can tell without experiments which can scarcely be made. In this city charcoal filters may be had of Mr.

street, for the small sum of five shillings. The most impure water, if boiled and passed through them, comes out softer, almost free from organic matter, bright, and well aërated.—The successive layers of sand and charcoal make them closely resemble Nature's mode of purifying water. A company in London has contrived an ingenious plan, by which the charcoal filter is placed out of reach by being fixed permanently in the cistern, as represented in the adjoining cut.



Cistern fitted with Charcoal Filter.

Boiling removes sulphuretted hydrogen from water; and carbonate of lime, oxide of iron, and some organic matter, are also cast down; but it also removes carbonic acid and air—hence the flat taste of such water. Water should be always boiled where an impure kind must needs be used, and its aëration, and consequent palatable and wholesome properties, can be readily restored by tossing from one vessel to another, as is well known. Boiling, being the most reliable and easiest mode of purifying, should be always advised in cities where cholera rages and where the supply is suspicious. Dr. Frankland indeed doubted the efficacy of this means, but, as was shown afterwards, on insufficient evidence. Even distilling water does not abstract all its impurities, for if rapidly brought over the organic matter, carbonic acid, sulphuretted hydrogen, and even some salts, will be found present, especially in the first and last portions. However, the late Dr. Normandy's plan for obtaining potable water for our sailors by distillation from the sea-water, and subsequent aëration, was a real boon, and like manny other really useful inventions, was simple and closely copied after Nature, for all our waters are originally had by evaporation from the sea. Freezing expels much impurity, and water obtained therefore by

melting ice may be generally relied on. The addition of Condy's fluid most effectually removes all organic matter, and also lead, iron, and other metals, if present as peroxides. The antidotal powers of this permanganate in cases of poisoning by metallic substances have not been investigated, though they promise satisfactory results. The manganese which would enter the system if water was thus purified would not prove injurious, as it is similar in its actions to iron, and it is, by the way, found plentifully in the bodies of Scotchmen, who use oats so freely in their dietaries. If the potash of Condy's fluid be thought objectionable, permanganate of lime might be used, as in presence of organic matter that earth would fall as the carbonate. About two ounces of Condy's fluid will render a hogshead of very impure water safely potable, and at a charge of less than a penny. Its patentee is, of course, a more enthusiastic advocate than those less directly interested; for instance, among many other uses, he advises it for daily ablution, asserting that soap leaves behind upon the skin some of the fatty acids. The oxidizing powers of the permanganate are much increased by a temperature of 150°.

Carbonate of lime in water, although useful in supplying the materials of our bones and in conferring a pleasant taste, may be in excess, and thus productive of disease, as we shall see presently. It may be removed, as discovered by Dr. Clark, by means which seem paradoxical—namely, adding fresh lime. The action of the process depends on the fact that much of the carbonate is dissolved by carbonic acid, with which the additional lime forms a carbonate, and both this and the originally contained carbonate are precipitated. Some entangled organic matter also falls. The plan is adopted in many limestone districts, and is carried out on a grand scale at the Herbert Hospital, Woolwich, and other institutions conducted on hygienic principles. The water with which this city will be supplied from the Vartry

will be so much softer than that now used, that the daily quantity distributed to the inhabitants will contain ten tons less of lime salts. This will lead to a great economy of soap, for it is calculated that the interest of the cost of the Glasgow waterworks is repaid by the saving in this particular, and each Dublin citizen will save one penny per week in washing, and something more in the economy of tea, when the supply of soft Vartry water is accomplished.

Notwithstanding the vast amount of intellectual labour which is lavished on the study of classics, but little of the sanitary knowledge which the Romans must have possessed has been made apparent; they seem, however, to have been well aware of the superiority of water carried from a distant pastoral district, and hence the magnificence of their aqueducts, of which there were twenty altogether, and one of them has been traced to a distance of sixty miles. Some of the arches were 100 feet high. The reservoirs, or *castella*, were of two kinds—*privata* for the houses, and *publica* for the baths, fountains, public buildings, and to supply the requirements of trades. A staff of several hundred men conducted the works, and were directed by a *curator aquarum*. The water was plentifully used in flushing the sewers, the arrangement of which was also on the grandest scale, for the *cloaca maxima* is 14 feet wide, 32 feet high, and constructed of Albano stone put together most perfectly. Modern engineers, by bringing the supply by gravitation from more elevated sites, have rendered waterworks less costly than they must have been in the cities of old.

The question of waterworks is one of the most important of the day, and in London it is now being debated whether they shall bring the supply from Wales or Westmoreland. The distribution of water by pumping is expensive. In London, for every 80,000 gallons raised 100 feet, there is an expenditure of one shilling,

but in smaller places the expense is proportionally greater. To show the greater economy of gravitation I may instance two works completed by Mr. Rawlinson, the famous hydraulic and sanitary engineer. In Berwick the 10,067 inhabitants were supplied with water by gravitation for £7,500, or at the rate of 14*s*. 10¾*d*. per head; while in Ormskirk, for 5,548 people £7,000, or £1 5*s*. 3*d*. per head, was expended on the works, and there will be a heavy yearly expense for steam-pumping.

The present water supply of this city is derived from three sources—the Grand Canal, which is stored in Portobello and James's-street basins; the Royal Canal, which fills the Blessington-street reservoir, and to a trifling amount from the Dodder, which is added to James's-street basin. This river, up to 1775, afforded the total supply for Dublin. The position of these reservoirs within the city must make them subject to pollution by careless or filthy people living near, and from dust and smoke. The quality of the water had been long creating suspicion in the minds of medical and scientific men, for it contained some 16 grains of lime-salts and much organic matter per gallon, while its scantiness at all times, and total insufficiency on the occurrence of fires, was apparent to every one. Along the lowest parts of the city, the quays for instance, the head of water is but 50 feet; over the whole city the average is half that; and many places are too high to get any supply. Some active members of the Corporation determined that, if possible, a purer and more plentiful supply should be had for the citizens, and a Royal Commissioner (Mr. Hawkshaw) was directed, in 1861, to investigate the subject. Evidence as to its unfitness for drinking was given by such eminent authorities as Prof. Apjohn, the President of the College of Physicians, Prof. Macnamara, and Dr. (now Sir William) Wilde. That of the Portobello basin was particularly

condemned, being found to deposit a large quantity of organic matter, which Prof. Apjohn described as follows: "I may add that it was of two kinds—a thready or filiform product, which, when examined under the microscope, appeared to be confervæ or fresh water algæ, and a membranous substance of a highly cellular structure, having some resemblance to certain of the spongiæ. The latter exhibited two appearances occurring on the sides of the basin and interior of the mains, partly as an incrustation of slight thickness, and partly as projecting growths, of the size and nearly the shape of the human fingers. The organized products just described were penetrated by numerous maggots, which had the faculty of spinning threads like those of the spider, executed rapid movements, and were capable of inflicting bites. When a mass of the mixed organic matter just described was placed in a basin of water, putrefaction rapidly set in, and in twenty-four hours an insupportably offensive odour was evolved."

In the field of this microscope you will see several species of minute plants and animals from some of our Dublin pipe-water.

All kinds of filth, such as drowned animals, manure soakage from tilled fields, and the refuse from the boats plying on the canal—which to the boatmen must have been as a house-drain—were added to the water. The boatmen were also in the habit of pumping bilge-water into the canal, but on the representation of the Sanitary Committee, the Company has obliged them to carry it by a pipe to the banks. Most of the Pembroke Township has been supplied with water carted from the Grand Canal at Maquay-bridge, where manure boats have added the most disgusting impurities. Prof. Cameron found it contained, total amount of solid matters per gallon, 22·16 grains; fixed salts, 16·10 grains; volatile and combustible matters, 5·06 grains; organic matter, 4·20 grains; nitric acid, large; nitrous acid, traces. Active

steps have, however, been since taken by the company and the police to prevent such evident pollution. This purchasing by the Sandymount and Irishtown people of water will cease as soon as the Vartry supply is attained; and indeed it is to be regretted that that inestimable fluid should ever be a matter of barter, for nature intended that it should be as free and plentiful as air. The disagreeable flavour of our water is constantly perceived by strangers coming to Dublin, but the sense of taste of the inhabitants is in many cases dulled by habit. More easily demonstrable evils resulted from the scanty supply, for water has not been within easy reach of the poor, especially in the Liberties, in part of which the Corporation pipes are not laid down. As an instance, I may mention that Dr. Ryan some years ago ascertained that of the fifty houses in Plunket-street, containing 800 poor, but one had pipes carried to it. Being dependent, then, on fountains, often at a considerable distance, the poor of this city, numbering over 100,000, have either to do without water, or in fetching it to get drenched with rain on wet days, or in stormy weather by the blowing about of the water. They have often to wait at the fountain a long time, amid scenes of contention, for their turn; and from the want of suitable vessels a sufficiency is rarely obtained. The consequence is, that one quantity is put through a round of washing operations, the foul-smelling suds polluting the air of the rooms for many hours; and under such circumstances personal cleanliness or salubrity cannot be hoped for among the poor or labouring class. But better things are in store for us; a magnificent system of waterworks is constructed to carry water from a mountainous, granitic, and pastoral district 22 square miles in extent, to collect it in an artificial lake 420 acres in area; and in softness, absence of colour, and purity, even without filtration, the water is not surpassed by that of any city in the empire. The rainfall of the district has for the last five years

averaged nearly 53 inches. The reservoir, or "Lough Vartry," near Roundwood, is 520 feet above the highest part of Dublin, and is capable of discharging 12,000,000 gallons daily, or about 35 gallons for each person in the city and suburbs. Near the reservoir a tunnel had to be bored through the solid rock for nearly 2½ miles, and this has unavoidably delayed the works. The valve-house and screen-chamber at Stillorgan, and indeed all the works, are most interesting, and have attracted many strangers to visit them. Air-valves have been placed at all summits, and scouring-valves at all low levels; and double mains, so as to obviate inconvenience from one being obstructed, have been laid. There will be also telegraphic communication to every part of the works. Forty-five miles of new mains have been laid. About 30s. per head of the 320,000 persons who will be supplied will cover all expense, which is a lower rate than in other cities. The composition of this Vartry water is exhibited in this table of the analyses of four of our most eminent chemists:

		Organic matter. Grs. per gal.	Total Solids. Grs. per gal.
Prof. Apjohn, T.C.D.	June,	1·70	4·40
Prof. Sullivan, M.I.I.	1855.	1·25	4·03
Prof. Barker, R.C.S.	August,	2·24	4·24
Mr. Plunkett, M.I.I.	1860.	1·24	3·29

As regards supply, it will be brought into, or within the easiest access of the house of the poorest, the cost being placed on the landlord, and already over fifty new fountains have been erected in situations where the supply has been scanty. The water will be on constant service and at high pressure—a condition always securing greater purity and economy of distribution through a house, and which is of the utmost moment when a fire takes place. The force will be, on the occurrence of such a calamity, increased by turning off the supply flowing to other neighbourhoods. Its constant motion will never allow the water to foul in the pipes. Two great

mains will diverge at Leeson-street bridge, and after encircling the city, will reunite at its western extremity, sending off in their course numerous inter-communicating branches. So far the arrangement resembles the arterial system of the human body, and when house-pipes are adjusted, and a full scheme of sewerage perfected, the analogy to the circulation in its arterial, capillary, and venous subdivisions will be indeed complete.

The following rules and regulations, with regard to domestic water supply, have been issued by the Water Works Committee of the Corporation of Dublin:

"They will not permit any fittings, pipes, taps, cisterns, or other appliances to be used for taking water from their mains, or using same within any house, premises, or other place, save such as are in accordance with the patterns selected by them from time to time. The Water Works Committee will not be in any way responsible for the perfection of any of the fittings, taps, or other appliances put up, or to be put up, in any house or premises, for the supply of water from their mains or pipes.

"Each householder will be at liberty to employ any of the plumbers or tradesmen he may select, who will undertake to supply fittings of the pattern selected. It will be the duty of each house-owner to make for himself all necessary provision for the perfection of the cocks, taps, &c., to be put up, all of which must be in accordance with the required rules. The patterns of cocks and other fittings, decided on by the Water Works Committee as those to be used, can be seen at the Engineer's Office, Corporation Stores, Winetavern-street, daily, between the hours of 10 a.m. and 4 p.m.

"The public can buy the fittings from any manufacturer or dealer willing to warrant the supply of same, but they must before being used be stamped with the Corporation brand, to ensure the buyer that they are of the proper pattern and bore. All fittings to be stamped at the office provided for that purpose at the Corporation Stores, Winetavern-street, the charge or fee for stamping being one penny for each article. The common ground plug-cock will not in any case be allowed to be used.

"1st. Ferrules—The Committee will in all cases provide, and fix at the cost of the party buying them, the brass ferrules by which the service pipes are attached to the mains, and the expense will be three shillings in addition to opening street, which will be charged at cost price.

"2nd. Service Pipes, quality of Leads, &c.—The lead pipes and

lead used for lining cisterns is to be alloyed with tin, and to be procured from the Mining Company of Ireland, and the materials must be branded to show that they are prepared agreeably to the Committee's specification. The following is the minimum weight of lead pipes, which has been settled on as suitable and safe to be used in Dublin, considering the heavy pressure which will be on the mains (150 to 250 feet), and no pipes of less weight will be in any case allowed: ½ inch, 5 lbs. per yard; ¾ inch, 8 lbs. per yard; 1 inch, 11 lbs. per yard. The Water Works Committee are of opinion that in many cases the existing service pipes will be of sufficient strength, and freedom from flaws, &c., to suit the new supply; they, however, earnestly recommend that when arranging the fittings, the plumbers be required to test the strength of existing pipes for flaws and defects, which can be easily done by the use of a force pump and a pressure gauge fixed on pipe.

"3rd. Stop-Cocks—A screw-down stop-cock must be fixed in the street on the service pipe of every house, protected by a metal hinged cover set in a granite flag, of the pattern selected and to be seen at office, and the charge for this work will be five shillings. In addition to this external cock, the Committee strongly recommend householders to have another stop-cock placed on the service pipe within the house, in some convenient place, easy of access, in case they might find it necessary to turn off the water in case of frost, &c., one on each storey is recommended for house supply.

"4th. Nose, Bib, and Stop-Cocks—Screw-down stop-cocks only will be allowed, and these to be of the pattern selected by the Committee—viz., the pattern known in the trade as Guest and Chrimes's single or double loose movable valve, and Lambert's diaphragm valve cocks. Screw nossels for the supply necessary for the washing of shop fronts, must be arranged according to special agreement. The material and workmanship must in all cases be of the best quality. Ball-cocks to be used, to be of the pattern known as Guest and Chrimes's high pressure loose valve-cock, or Lambert's patent equilibrium ball-cock. As it is usual for plumbers to fix the levers and balls to these cocks, the following length of lever and size of ball must be used:

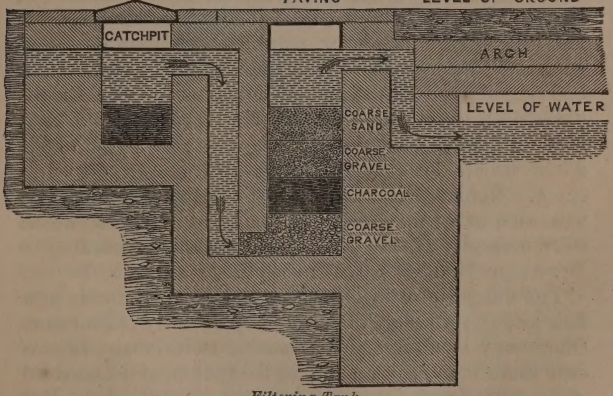
Size of Cock.	Length of Lever.—Size of Ball.			
	Guest & Chrimes.		Lambert's.	
Inches.	Inches.	Inches.	Inches.	Inches.
½	10½	5	12	5½
¾	12½	6	12	7
1	14	7	14	8

"5th. Cisterns—All new cisterns if lined with lead, the lead must be alloyed with tin, and be procured from the Mining Com-

pany of Ireland, who have undertaken to have it prepared agreeably to the Committee's specification. All cisterns provided with overflow pipes must have those pipes so contrived, that their discharging orifice or mouth must be visible to the occupiers of the house, or to the inspector, turncock, or police going their rounds, so as to insure there is no waste of water. The position of waste pipe to be approved of by the City Engineer, or other authorized officer. The top of the house is recommended for cisterns.

"6th. Water-Closets—No water-closet will in any case be allowed to be supplied direct from the main or service pipes. All closets must have an apparatus to prevent waste of water, to be approved of by the officers of the Committee. A bath of not more than 60 gallons, and without an overflow-pipe, will be allowed without charge."

For the inestimable blessings of a free and pure supply of this health-giving element, not only the present generation, but many future ones, will owe much to the zeal of the Corporation, their Engineer, and the unparalleled energy of Sir John Gray, M.D., M.P., the Chairman of its Water Works Committee. At foreign



Filtering Tank.

military stations, rain water is collected, filtered, and stored in the way depicted in this wood-cut, copied from

that recommended by the Barrack Commissioners, and the supply of Constantinople and Venice is from the same source, stored in conical cisterns under the houses.

The material most suitable for cisterns or main pipes is cast iron, but for small vessels, slate or earthenware may be used. Even for house-pipes there is nothing so good as iron, if galvanized to prevent rusting. All substances which allow permeation of fluids should never be used for storing water—as soakage from refuse would then readily occur—and the tank should be covered to exclude pollution from the air. If the dustbin or cesspool be close to the water cistern, and the latter uncovered, all kinds of filth may be blown into it—especially as servants are careless. Iron precipitates organic matter, as was conclusively shown by Medlock, who found the entire of the organic matter, 2·1 grains, of the water of the Dune Canal, Amsterdam, was thrown down as a brown deposit by remaining in contact with it for forty-eight hours. The nauseous taste of the water was thereby removed completely. Even water rendered impure by sewage, urine, or sulphuretted hydrogen, it is said, can be rendered fit for drinking by exposure to iron and subsequent filtration. The result is due to the production of the powerful oxidizing agent, nitrous acid, from the nitrogenous organic matter; and any of the metal which becomes dissolved can have no hurtful effect. Some advise, however, the coating of iron pipes with zinc or varnish, and the mains of our new works will be varnished, both inside and outside, according to Dr. Angus Smith's patent method.

The danger of using lead for pipes or cisterns is now well known; the case of the late royal family of France at Claremont having made the matter notorious. In this case there was $\frac{1}{10}$ of a grain in the gallon, and one-third of the persons, who drank this water were affected. But even $\frac{1}{100}$ of a grain per gallon has produced palsy in those who drank this impurity habitually. If the water

contains much organic matter, there is great danger, for the nitrogen so supplied forms nitrous acid which dissolves the metal; but very pure water will also act on it—thus the extremely pure water supplied to Manchester will take up the $\frac{1}{5}$ of a grain per gallon in twelve hours, and deaths by lead poisoning have thus occurred in that city. Notwithstanding the interest excited by this subject, some facts are as yet undetermined. Thus, we do not know why Thames water will at one time dissolve lead, and not at another. One fact, however, is certain—this metal, unless alloyed with others should never be used for the storage or conveyance of drinking water. The means for collecting water in countries where it is scarce and impure forms now a portion of military hygienic instruction, and one of the best and readiest means for this purpose is a barrel pierced with holes, and placed inside a larger one, also pierced, the interval being filled with charcoal. Many impurities are thus strained off, and until such plans were adopted, the French soldiers in Algiers are said to have often swallowed leeches in drinking.

The quantity of water which should be ingested daily under the guidance of the sensation of thirst, varies much, and in these countries averages some three pints; but in the tropics, where evaporation is so enormous, eight pints are permitted by military regulation. For cleansing purposes and flushing of sewers from fifteen to twenty-five gallons daily per head are said to be requisite, and fully this quantity was to have been supplied to each individual in Liverpool by the new waterworks. However, according to the local act, the mills along the water-course had a primary right, and powers are being sought to obtain a more extensive supply. They boast in New York that the Croton Works allow 300 gallons per head; yet on the late sanitary survey very many houses were found destitute of supply. The baths of ancient Rome were so enormous that this amount was

indispensable. In manufacturing towns the quantity should be one-third greater. As long as it is insured that no waste occurs, pure water ought to be supplied abundantly within the reach of all, and it is nearly as unfit that water should become a commodity as that air should. In 1817 Lord Cockburn wrote: "Standing in a rainy country, Edinburgh has been always thirsty and unwashed—the condition of the city in reference to water positively frightful;" and that matters in that great city are not much bettered even now, would appear from the forcible "Lectures on Public Health, in relation to Air and Water," of Dr. Gairdner. In large cities drinking fountains are always most useful, and that they are largely partaken of may be learned from the fact that 90,000 drinkers daily have been counted at that in Bethnal Green, London. When we get our new pure and plentiful supply, no better means for exercising benevolence, or honouring the memories of our departed great ones, could be adopted than the erection of such fountains, if they can be made at all ornamental, and not allowed to become dry, as most of them in Dublin are.

Provided means are taken to prevent waste, the erection of water-closets should be encouraged in every city. The waste-box or cistern now in use serves the purpose of preventing waste. A gentleman lately remarked in my hearing, that such an apparatus would be disarranged by the poor, and recommended a member of our Health Committee to try it in a few parts of the city, to see if it would succeed. This gentleman, however, was so confident of its efficacy that he said he might as well advise umbrellas "to be tried in a few parts of the city." However, with the present scanty supply of this city, I hesitate to recommend the erection of such conveniencies, as I fully agree with Mr. J. H. Owen that the formula W C—W is always to be condemned.

If I have succeeded in showing the necessity of a

plentiful supply of pure water to the human body, you will not be surprised to hear that many diseases owe their origin or increase to a scanty amount or impure condition of that fluid. The metamorphosis of tissue, or the removal of old material and the deposit of new, which is momentarily taking place in our bodies, is much influenced by the great solvent, water, and it is found to be unduly promoted by too much of this liquid food, and still more hurtfully checked by too little. Evils from excessive thirst are very rarely experienced in these countries at least, but the debility and emaciation produced in those who fanatically pursue hydropathy illustrate the former condition. I have not time to touch upon the curative powers of water, which have been unfortunately monopolised of late by the grasp of charlatanry—although, in truth, this "water cure" is as old as the Deluge, and like it, as Charles Lamb said, "killed more than it cured." At the same time, it is to be regretted that calm and judicious physicians have not worked out the real benefits it is capable of conferring in the cure of disease, for they may equal the innumerable advantages towards the prevention of sickness, and promotion of health and cleanliness, to be derived from this inestimable gift of Providence. As Baron Liebig has been stated to be favourable to hydropathy, I may be allowed to quote his sentiments in his own words: "The existence of hydropathic institutions—those dens of covetous and rapacious gamblers, where the wretched invalid resorts to throw dice for health and life; the rise and progress of the homœopathic system, which treats truth with scorn and bids defiance to common sense, loudly proclaim the need which exists for the adoption of settled principles, definite methods of research, and a systematic arrangement to guarantee their attainment and retention."

The effects of excess of calcareous salts in water are difficult to recognize, as they are insidious and take a

long period for their development; but a peculiar form of dyspepsia is now often assignable to this cause, as well as diarrhœa and subsequent dysentery. These diseases have become much less frequent in Glasgow since the very pure water supply from Loch Katrine. Prof. Cameron found 84 grains per gallon of sulphate of lime (plaster of Paris) and 168 grains of total solids in the pump water of one of the fashionable clubs in this city, and attacks of diarrhœa and cholera were experienced by some of those who drank of it. That analyst also found nearly 109 grains of the same salt in another pump water, and as it does not naturally exist in the rock formation of Dublin he supposes that it results from the decomposition of sulphide of iron and carbonate of lime. Horses supplied with water charged with sulphate of lime often lose health, as grooms notice by the roughness of their coat. Bony tumors in cattle, and some forms of calculus in man, have been said to have been more frequent from impregnation of water with this and other calcareous salts. The diseases, however, which have been shown by recent scientific labours indubitably to depend on such causes, are goitre and the lamentable state of semi-idiocy called cretinism which sometimes accompanies it. In Durham gaol goitre was very prevalent some years ago, and it was found that there were 77 grains of lime and magnesia salts per gallon in the water the inmates drank. The disease decreased in those affected, and no new cases appeared after the amount of these salts was reduced to 18 grains. It has been traced over limestone districts in several parts of England, Switzerland, and India, and in this country the same distribution of the disease has been shown by Dr. Martin of Portlaw, for it was prevalent on the Kilkenny side of the river Suir, where the stratum was limestone, and almost never seen on the Waterford side, where it was old red sandstone and silesian slate. In Gorruckpore the soil upon

which many villages is built is so calcareous that some specimens contained 25 per cent. of carbonate of lime, and 10 per cent. of the adults are affected with goitre, and about an equal proportion of the children are afflicted with the pitiable state termed cretinism. The bones of the skull are found so altered in shape and their openings so contracted that it is supposed that the lime and magnesia salts are deposited in them, and this condition is believed by some to be the cause of this kind of idiocy, by interfering with the circulation of the blood in the brain. The dogs and cats are said even to be affected by the lime-salts.

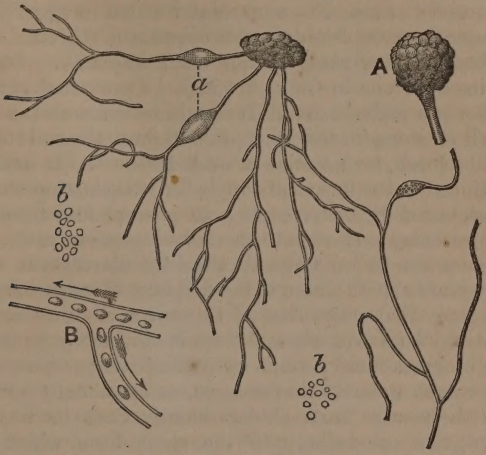
Outbreaks of diarrhœa and dysentery are often attributable to organic matter in water, more especially if it be that variety which is derived from sewage and is undergoing decomposition. Dr. Greenhow records a notable instance. In the Southwark prison, for one day only, the water was drawn from a tank, the overflow pipe of which communicated with a sewer; nearly all the inmates were attacked with severe diarrhœa, which in nearly all instances began within the twenty-four hours succeeding the introduction of the poisonous water. The discharges in dysentery are especially hurtful, and are even so when the attack has been due to mere exposure to cold: an example of the origination of a spreading disease is thus afforded. Typhoid fever is now believed to be due to the introduction of sewage matter in this way; or, according to others, it is necessary that the peculiar morbid matter excreted from the bowels of a patient already attacked should find entrance. In the charity convent at Munich, 31 out of the 120 inmates were suddenly taken ill, 14 with typhoid; and the well-water was found to have been polluted with the dejections of typhoid patients. All sickness ceased when the water was disused. Bedford has been a favourite habitat of typhoid fever. Let me, therefore, read you a few facts from the report of Mr. Simon exhibiting the

nature of its sewerage and water supply: "The drainage of Bedford is most defective. Cess-pools are almost universal; there are said to be upwards of 3,000 of them. They soak all their contents into the soil, for the local act forbids any drainage of them into the sewers. The refuse of 1,300 people thus percolate into the wells from which the water supply is derived." Some months ago nineteen persons in a large house were attacked with typhoid fever from drinking the water of a well, within four yards of a cess-pool. As is often the case with regard to the most poisonous water, this specimen was beautifully sparkling, and had no bad taste or smell; but the microscope displayed crowds of organic forms, and analysis revealed nitrous acid and organic matter in abundance. In the West Indies, dysentery has been often shown to depend on the impurity of water; and so well was this known, that it was not unusual for guests invited to dinners to bring their drinking water with them. The fearful losses by dysentery at Cuidad Rodrigo were attributed to the drinking of water which flowed through a cemetery in which 20,000 bodies had been hastily buried.

I will cursorily allude to the fact, that cholera is due to the use of contaminated water, and will lay before you some of the instances which seem to corroborate that view; and first, of the famous Broad-street pump. The cholera broke out in this neighbourhood in 1854, and killed 500 people in less than one week. Dr. Lankester examined the water of it, and found the remarkable fungus, his representation of which I show you on next page.

According to an analysis of the late Dr. Dundas Thomson, it contains over six grains of organic matter derived from sewage. The clearest case where cholera was due to it was that of a lady, who having resided in the vicinity, moved to Hampstead, some three miles distant. The pump-water in Broad-street was so sparkling

and pleasant, that she sent daily for it. She and her niece were the only persons attacked with cholera in Hampstead, and her servant suffered from severe diarrhœa. This fact of the water of a dangerous source being



A represents the spore-case, and B *one of the branches, with particles moving through it.*

apparently good, and being often a favourite with those living near, should not be forgotten; the sparkling character indeed depends on the impurity of which the carbonic acid is at once the cause and the remedy.

These evils ensue from allowing shallow wells to be used into which sewage matter soaks; and although their unfitness has been often demonstrated, it was not until lately generally understood, for we find three chemists who were appointed to examine the waters of the metropolis reporting in 1851: "That the shallow wells of London have never been pronounced unwholesome." I know of a well in Dublin some dozen feet deep, which supplies abundantly water stinking abominably of sul-

phuretted hydrogen and decomposing animal matter; and Dr. Lankester gives a figure showing the crowd of plants and animals, and their organic food, contained in water from a surface-well at Sandgate, which he tells us produced disease. The sewer water which he also figures is scarcely more crowded with disgusting objects. The wells near grave-yards contain much impurity. I know for instance one in Cork, in which 15 grains of organic matter per gallon exists. It should be remembered that a well of some 70 feet in depth will drain the soil round, if it be loose, for a radius of even 100 feet. If wells be continued as the means of supply for villages, they should be protected by water-coping, to prevent filth from the surface being washed into them during heavy rains.

There can be no doubt that serious diarrhœa in ordinary years can be traced to the drinking of impure water, especially that contaminated by sewage or other animal matter. In times when cholera is epidemic, the impurity becomes more serious by predisposing persons who drink such water to this scourge, or by actually spreading it if the sewage from cholera-haunts finds its way, by soakage or otherwise, into the earth from which the water springs.

It was for this reason that Prof. Cameron and I determined to examine the well and pump waters in this city at the recent outbreak of cholera. Many were found very impure, but in the following there was such imminent danger, that we resolved to have them closed forthwith. The results of the Professor's analyses are as follows: St. Nicholas's well, livery stable yard, Francis-street—total amount of solid matters per gallon, 38·63 grains; fixed salts, 33·08 grains; volatile and combustible matters, 5·55 grains; organic matter, 4·05 grains; nitric acid, excessive; nitrous acid, large. Pump in a stable-yard, Lamb's-court, Corn-market—total amount of solid matters per gallon, 39·93 grains; fixed salts, 33·98 grains; volatile and combustible mat-

ters, 5·95 grains; organic matter, 3·86 grains; nitric acid, excessive; nitrous acid, large. Pump in Farrell's yard, Marlborough-street, within one foot of St. Thomas's grave-yard—total amount of solid matters per gallon (70,000 grains), 41·97 grains; fixed salts, 35·80 grains; volatile and combustible matters, 6·17 grains; organic matter (estimated), 3·10 grains; nitric acid, large; nitrous acid, none.

The dependence of cholera upon impure water has been clearly proven by the admirable researches of the medical officers of health in London. Dr. Dundas Thomson says:

"But perhaps the most horrible example on record of the fatal effects of impure water occurred in 1854. I found that the Southwark Company's water was of a different composition from the water of the Lambeth Company. When I applied a piece of muslin over the supply pipe of the Southwark Company to the cistern in my laboratory at St. Thomas's Hospital, a large quantity of human excrement was detained, and the impurity in solution was much greater in the Southwark Company than in the Lambeth water, which contained little or no matter in mechanical supension. The Lambeth water was obtained from Hampton, while that of the Southwark Company was pumped up from the river near Vauxhall-bridge. These two companies possessed mains in the same streets, and supplied the houses indiscriminately. Analysis alone enabled me to detect the two waters, as the inhabitants, without consulting their water receipts, were unable to state the source of their supply. And although the population supplied by the two companies was precisely in the same condition, except as to water, the cholera deaths in the houses supplied by the Lambeth Company were 37 to every 10,000; and in those by the Southwark Company 130 to 10,000, or as 1 to $3\frac{1}{2}$. I conclude from the data supplied, that 2,500 persons were destroyed by the Southwark water, who

would have been saved if they could have obtained the Lambeth water. It is a remarkable fact that the Lambeth water, in the epidemic of 1848-9, was more fatal in its effects than the Southwark, the Lambeth Company taking their water lower down the river at that time. The mortality in houses supplied by the Lambeth water was 125 in 10,000, while the deaths in houses supplied by the Southwark water were 118 in 10,000."

The same energetic physician records it as a matter of general belief in India, that cholera is producible mainly by water; and he relates the following instances of the way in which reservoirs of that inestimable fluid are treated: "One large tank, I recollect, which was used for the supply of water, had located on its banks several faquirs, who had resided there for years. One of these who had made a vow to allow his nails to grow for twelve years, attracted my attention particularly by the remarkable appearance of his nails, which resembled ram's horns in being twisted and indurated to the extent of six inches. I was desirous of getting a specimen of his cast-off nails for my museum, but he replied it was part of his vow to throw them into the tank, where also all excretions were deposited, and where his ablutions were performed, according to his own statement. These waters contained much organic matter in solution, *a considerable amount in suspension*."

I endeavoured to prove in foregoing lectures that the circulation of pure air was a duty we owe to ourselves as well as to our neighbours, and that allowing it to be confined and fouled, was doing serious injury to others; and the same consideration is of even greater weight with regard to water. When it is remembered, therefore, that diarrhœa, cholera, and typhoid fever, are propagated by means of contaminated water, and that probably other diseases have a similar origin, no arguments are needed to prove that a supply of that requisite, pure and above all suspicion, is desirable for our towns; yet

every town in Ireland, with three or four exceptions, derives its supply from superficial wells or pumps, or from the rivers passing through; and such sources are rarely, if ever, free from pollution. Some years ago Dr. Voelcker, the eminent chemist, found that the water of many superficial town-wells contained three times as much organic matter as the tank liquid with which Mr. Mechi was manuring his land.

I believe the geological structure of Ireland does not often afford artesian wells, but deep wells or pumps, the circumference of which should be of cemented brick, and puddled to prevent all soakage, and placed in situations away from cesspools, should be freely provided in small towns and villages. For larger towns—Sligo, for instance—a supply from a lake, stream, or catchment basin in a pastoral district, should be always obtained and distributed by pipes to all houses in the town. For the borough I have named a water bill is now before Parliament, under which it is proposed to carry a supply from a river three miles from the town, and this is one of the many benefits which dread of cholera has wrought. A river which has passed a town should never be used as a source for drinking water, even if the sewage should have been utilized on the land. The sewage water from the town of Croydon, after being irrigated over the farm for the purpose, passes limpid and apparently pure into the river Wendle. I have examined it, however, microscopically and chemically, and find it loaded still with organic matter. Indeed, when kept; it throws down a filthy sediment and smells badly. A year ago, at the Society of Arts, Mr. Baily Denton, the eminent engineer, proposed a mode of water supply for small villages which was approved by other eminent engineers and sanitarians. It was that the water of under-drainage, which has filtered through four feet of earth, and which is remarkably pure, should be collected in the most pastoral neighbourhood of the village. For a village of 100

houses from 7 to 12 acres would suffice, and the whole expense, including the purchase of a reservoir $\frac{1}{16}$ of an acre in extent, to give water for the four summer months when wells are dry, would be £415, which a yearly payment of 5*s*. 3*d*. on each house for 30 years would refund.

We are told that in the middle ages, when pestilence seized upon a town, the citizens put to death the physicians, believing they had poisoned the wells—an accusation which has often been made since even the days of Thucydides—and they built over all these sources of polluted water. Such suspected pollution was also often made a pretext for persecuting and expelling the Jews from the towns. When cholera spreads in some towns where the authorities provide no safe water-supply, they will deserve punishment, although of a milder nature than that which the barbarism of the dark ages inflicted.

That yellow and marsh fevers are due to the water the patients have drunk, is credited by many mainly on such evidence as the following. All on board a ship which had watered at Jamaica, except those who messed at the captain's table, were attacked by yellow fever. The water used by the captain and his friends was brought in the out voyage from Europe. The transport ship *Argo*, which in returning to Marseilles took in a water-supply at a creek in Algiers, and many on board were seized with ague, while no case of that disease occurred on board a companion ship which made the same voyage, but did not water off Algiers. Ague is rife in Indian villages, where they drink ditch and marsh waters, and the disease is more rapidly produced, and is far more fatal, than when caught by the air. Prof. Parkes thinks that the extraordinary decline of the disease in England may be due to the purer water now used.

Many diseases—for example, yellow fever and boils—were at one time believed to be producible by sulphuretted hydrogen in water, but that gas abounds in the Harrogate and other sulphur springs, which give rise to no such effect.

It may be regarded as almost proven that the eggs or embryos of many parasitic worms—such as the common round worm of children, the guinea worm, and broad tapeworm, the rare one in this country—gain entrance into the human body by means of the water we drink; for, as no one believes now in the doctrine that they are spontaneously generated, in either our food or drink they must lie concealed.

The influence of a scanty water-supply in promoting typhus and skin diseases, I shall speak of in a future lecture.

LECTURE V.

INFLUENCES OF SOIL AND CLIMATE ON DISEASE—CLIMATOLOGY OF IRELAND.

The plants which man consumes as food, and those which feed the animals he makes subservient to his uses, derive their sustenance from the soil or surface-crust of the earth; the atmosphere and waters which surround him also are influenced most powerfully by this soil, so that it becomes nearly as important a factor in determining questions of public health as the air we breathe or the water we drink; and again, as there is a constant mixture in nature of air and water, and as the varying conditions of these constitute the science of meteorology, I have thought that the subjects of soil and climate should next engage us. All soils consist of crumbled rocks broken down by the action of air and water, and mingled with vegetal and animal matters; but they may be arranged in three classes according to the preponderance of each constituent—thus, calcareous soils contain carbonate of lime plentifully, the sandy possess much silica, and the clayey consist almost entirely of alumina. The farmer delights in a mixture of these, which, under the name of loam, has been always regarded as most fertile.

Besides the vaster metamorphoses which heat in past epochs has wrought in the geological features of a country, changes are constantly occurring in the nature of soils; for instance, the clay or lime is washed from the higher to the lower levels, leaving but the barren quartz behind. In drier countries winds will act similarly, and will carry off the richer soil as dust to other districts; or if blowing from the sea, they may render sterile cultivated fields, by covering them with sand. By the wind

also are carried those innumerable germs of plants which clothe with vegetation coral islands shortly after they have been projected from the bosom of the ocean.—Water along the banks of rivers carries away and sorts various soils, and give rise to what are termed alluvial deposits; and lastly, dying trees or smaller plants accumulate and blacken into humus or peat in situations where shallow water rests on an impermeable bottom—circumstances which concur in so large a portion of the western and central districts of this island. In other countries vegetal matter acted on by fire in past ages has given us coal; and from the excretions of animals such rich mines of agricultural wealth as the guano of Peru or the coprolites of England have resulted.

The degree to which each variety of soils retains heat is the first hygienic circumstance concerning them I shall notice. Sand excels all others in this respect, and if its capacity be represented by 100, that of light clay will be 76, pure clay 66, calcareous matter finely powdered 61, and humus or peat 49. The suitableness of a sandy soil for bivouacking in the colonies depends on its great retaining power for heat. The capacities of these soils in absorbing and holding moisture is in reverse order; and with regard to humus, so great is its thirst for water, that it will attract fifty times as much in a given time as a sandy soil. In the ordinary sea-sand there is contained two gallons of water per cubic foot, and even in the densest limestone half-a-gallon. The permeability of soils to water and to air, and their capability in lodging subsoil water, have, as we shall see hereafter, a most important bearing on the generation of cholera and typhoid fever. Even the colour of a soil is an item in its climatic features—the dark-coloured absorbing and radiating heat, the light-coloured reflecting it. Humus and clay have, moreover, the property of retaining organic matter, some of which must, however, undergo destruction by oxidation—or else the accumulation

of vegetal *débris* in forests, or of animal refuse near cities, would render whole districts uninhabitable. Vegetal matter is slowly destroyed—for instance, the soil of the Tuscan Maremma contains 30 per cent., and to this is probably owing its malarious effects.

The affinities of different soils for heat, moisture, and organic matter, have an important bearing on the question of what are the proper sites for camps or hospitals, a subject on which Miss Nightingale has the following apposite remarks:

"As the object to be attained in hospital construction is to have pure dry air for the sick, it will be evident that this condition cannot be fulfilled if a damp climate be selected. It is a well-known fact—*e. g.*, that in the more damp localities of the south of England, certain classes of sick and of invalids linger, and do not recover their health. Again, retentive clay subsoils keep the air over entire districts of the country always more or less damp, and soils of this character should not be selected as sites for hospitals. Self-draining, gravelly, or sandy subsoils are best. River banks, estuary shores, valleys, marshy or muddy ground, ought to be avoided. It may seem superfluous to state that an hospital should not be built over an old graveyard, or on other ground charged with organic matter—and yet this has been recently done. Although hospitals are intended for the recovery of health, people are very apt to forget this, and to be guided in the selection of sites by other considerations—such as cheapness, convenience, and the like; whereas, the professed object in view being to secure the recovery of the sick in the shortest time, and to obtain the smallest mortality, that object should be distinctly kept in view as one which must take precedence of all others." Such principles also should guide the immigrant in choosing his settlement in our colonies.

The configuration of the ground is also important, for

a flat or concave surface will allow the accumulation of water, which can scarcely be drained off, but must escape by evaporation, and promote malarious and other diseases, as I have already ascertained to be the case with some of the most populous districts in our city. Every rural physician will be able to call to mind the spots where fever most frequently requires his presence, and they will be usually found to be the low-lying misty places, especially if cesspools add organic matter to the air, for the moisture of the atmosphere renders the latter much more hurtful.

The amount of vegetation is important in determining the salubrity of any place; thus while herbage is always useful, brushwood, by preventing the access of the sun's rays, evaporation, and the movement of the air, is most injurious; and lastly, trees, if not too close, serve the healthy purposes of moderating wind, affording shade, and checking the spread of malaria. Cultivation has usually rendered unhealthy places much more salubrious, although when first commenced in countries where the soil abounds in decomposing organic matter, ague and similar maladies have quickly followed when the earth was first turned. Cultivation will, moreover, always be the great spoliator of land, if means be not taken to restore to it the constituents which are abstracted from it by plants; and the evils of this error are very apparent in some colonies, especially in those regions of North America which have been cultivated for the first time. For instance, a settler establishes himself upon a fertile spot, and in a few years so exhausts it of materials which he takes no care to replenish, that it becomes barren, and he is forced to desert it to inflict the same injury on another district. From like causes the Campagna, which once supported thirty flourishing cities, is now a desert. Such results could not occur if the land had had restored to it, by manuring with animal and vegetal refuse, the elements of which it had been de-

prived. The physical or geographical circumstance which most closely influences the salubrity of a district is its elevation, which, if moderate, affords most favourable conditions; and the natives of elevated districts are always hardier and more enterprising than those who dwell on plains. In ancient history, mountaineers were nearly always the conquerors, lowlanders the conquered. The atmosphere of elevated localities is usually cold, dry, and free from such organic or artificial gaseous impurities as I have spoken of in previous lectures; and as refuse rapidly drains off, the water is usually pure. Elevation is the chief climatic condition which is preventive of consumption, and in California and some Alpine situations, cure of the disease is believed to follow a change to mountainous residences. That it is the open air exercise which produces the good effects would seem from the fact, that on the Swiss heights the men are free from consumption, whereas the women, who work with the needle in close rooms, are very subject to it. You will remember the facts I submitted to you, showing the connexion between altitude and typhoid fever; yet the latter disease, while generally traceable to imperfect sewerage, has been observed among the hunters on the Rocky Mountains by Dr. Hammond, the late Surgeon-General of the United States army. The salts of mountain springs and streams varies with the geological substrata, and as they are often calcareous or magnesian, the proclivity of the inhabitants of hills, or the valleys between them, to goitre or cretinism, is thus accounted for.

Sunlight does not act on mountainous places so freely as on the plains, and this want of insolation, in conjunction with the low temperature, produces that stunted and blanched or etiolated character occasionally seen. The obstruction to light which the smoke of cities, where manufactures are carelessly conducted, is highly promotive of consumption and general enfeeblement.

Even in the hottest climes—India, for example—elevated spots with moderate temperature occur, and are taken advantage of in that country for the erection of sanitaria for our troops. The bracing air and exhilarating scenery which may be enjoyed upon mountains are remarkably efficacious in promoting recovery from debilitating diseases, and I regard the Dublin mountains as perfect sanitaria, from some experience of their powers in restoring health to patients whom I have urged to reside on them for some weeks. The breathing capacity of those dwelling at great altitudes—for instance, the Inca Indians—is most enormous ; and this may account for the preventive power of such residence over consumption, for greater efforts are required to inhale enough oxygen in such a rare atmosphere, and the chest becomes enlarged and the lungs expanded—even the upper parts of them, which are especially prone to disease from being disused, now dilating. Circulation, and all the nutritive functions to which it ministers, becomes more active. Long-continued residence at great heights is, however, said to be injurious to those born in lower regions ; thus, the monks of St. Bernard cannot remain at their hospice, which is 7,668 feet above sea level, for more than a few years.

Plains differ very widely in a sanitary point of view accordingly as they are high tablelands, or are sunken between elevated lands ; the former are most healthful, as exemplified in the interior of Spain, which presents the strongest contrast in salubrity with the coast ; the latter frequently have an alluvial soil, and are highly promotive of malarious disease. In Mexico there are, however, malarious marshes at a level of 6,000 feet above the sea. Valleys in the midst of mountains, or what are in this country so often called "punch-bowls," are insalubrious from a want of free circulation of air. The plains at Walcheren, on which an army of 43,000 men almost entirely perished in a few months, are below

high-water mark, and are surrounded by dykes, the soil being principally sand.

The sea-shore is healthful because of the purity of air, its abundance of ozone, and the delightful freshness and stimulating influence of the scenery, more especially the exquisite alternations of light and shade which the ocean presents. The humidity of the air, and the cold winds which often prevail during the winter and spring months, make it, however, an undesirable resort for many pulmonary and rheumatic invalids. Places at the mouths of rivers are much less healthy, as organic matter in abundance collects about them, more especially if the river has been the main sewer of the town. In India nearly one-third of the surface is covered with alluvial deposit, and hence much of its unhealthiness till drained and cultivated. The prevalence of ague, fever, and other zymotic diseases in Cork, and its high death-rate, as well as that of Limerick, seem to be partly explicable in this way.

Latitude, or distance from the equator, is an important factor in determining the complex question of climate; but disturbing influences, some of which I have already set before you, render the subject one of peculiar difficulty, which even the profound Humboldt acknowledges when he says: "If the surface of the earth consisted of one and the same homogeneous fluid mass, or of strata of rock having the same colour, density, smoothness, and power of absorbing heat from the solar rays, and of radiating it in a similar manner through the atmosphere, the iso-thermal, iso-theral, and iso-chimeral lines would all be parallel to the equator. In this hypothetical condition of the earth's surface, the power of absorbing and emitting heat would everywhere be the same under the same latitude."

As an instance of these disturbing circumstances, I may mention insular position, for temperature and other climatic features are more equable in islands than on

continents, owing to the power which the ocean has to distribute heat and moisture; seasonal changes are, therefore, less sudden, and periods of rain or drought less prolonged. Our own island, warmed as it is in addition by the gulf-stream issuing from the Gulf of Mexico, illustrates these natural advantages, as also does that not sufficiently valued bathing-place, the Isle of Man, which in coolness of summer and mildness of winter is not equalled by any part of the mainland of the British Isles.

I have perhaps, dwelt at sufficient length on previous occasions on the circumstances which depress the salubrity of cities, when talking of the impurities which pollute their atmosphere, and the difficulties which attend their purification by natural means, because of the scantiness of vegetation and the close and irregular way in which their streets are too often built. I shall, therefore, now merely mention the fact, that the temperature of towns is kept higher than in the surrounding country by the numerous fires, by over-crowding, and by the absorption of heat by stone and brick. The mortality of cities is for these reasons somewhat greater than that of rural districts, other things being equal, but they are free from diseases of malarious origin.

The first climatic condition of which I shall note the effects on the health of man is temperature, and in estimating this item, the annual and monthly mean must not be the only information recorded, for the maximum and minimum, as well as the rapidity with which they fluctuate, are really more important, especially in their influence on the breathing organs, including the skin. Two places may have mean temperature of 65°, yet in one the fluctuations may be between 30° and 100°, while in the other the climate may be so equable as to range but from 60° to 70°. The variations in the former case are especially pernicious if they occur with suddenness, as is painfully illustrated in that grave of

our countrymen, New York. The poor emigrants who arrive there with but a single suit of clothes are prostrated in hundreds by bronchitis, or by its frequent result in ill-fed persons, pulmonary consumption. I may mention that the mean daily temperature can be readily determined in any place by observing the degree exactly at sunset, as Humboldt discovered. The method which the same philosopher recommends for ascertaining the mean annual temperature—namely, examining water just as it issues from a spring—is not reliable, for depth and other circumstances produce every variation in springs between those that are near the freezing point to those that are thermal almost to ebullition.

What everyone knows of the effects of the hot dry air of a bath upon the human skin is true of the influence of a hot dry climate, for both extremely promote cutaneous action, which, by the evaporation of the perspiration, obviates to a great extent their great heat. No very high temperature is endurable in moist air, for perspiration cannot be then so free, and diseases of internal organs ensue from the excessive rush of blood to them. In hot climates—India, for example—the skin acts so freely that little water is left to carry off the waste matter from the kidneys; the lethargy which prevents exercise produces torpid livers, and these circumstances effect the types of disease which prevail. Without proper ventilation in caps, the heat of the head may be raised so high as to endanger the due circulation of the constituents of the blood or the action of the nerve currents. In parts of Australia the solar rays heat the ground so powerfully, that it is stated matches are inflamed if they fall on the earth. In Africa, on the other hand, it is not the tropical heat which is so baneful, but the great humidity and the rank vegetation which covers the uncultivated parts of the country. This last-named condition has been partially removed, and the awful mortality of British troops on its western stations has

been much diminished. Of 1,658 soldiers sent there in the eight years ending 1830, 1,298 died, and only 33 remained fit for service. The dampness of the air is so great that all steel instruments, even the ladies' needles, have to be kept immersed in oil. As in other humid regions of the torrid zone, the diseases are malarious, such as yellow fever and ague; or are such as are rendered more frequent and fatal by its influence, diarrhœal and dysenteric complaints, for example. These latter diseases produce in India also the greatest numbers of deaths.

The effects of dry and moist years upon disease are quite evident in our own country; about one in every five is extremely dry, and then fevers or cholera prevail, because of the difficulty with which excreta are washed away; and one in ten is excessively wet, when influenza is the zymotic we hear most of. A cold, damp air rapidly abstracts the heat from the body, and is often said to "chill one to the bones." A dry wind is said to suppress the development of small-pox, which it is said for this reason cannot be inoculated in some parts of the west coast of Africa. The year 1860 was excessively wet all over England, and the summer temperature was very low. The deaths were very few, and in Birmingham were lower than for twenty-four years before.—Observations made at Greenwich indicated that positive electricity was very scanty in the atmosphere during cholera epidemics. The effects of electricity, however, upon the health and disease of man is a subject on which but little has been as yet satisfactorily determined.

Cold is our most powerful depressing agent, and if intense and prolonged, it extinguishes life by injury to the nervous system, as has been generally known since Captain Cook's graphic account of its effects on the surgeon of his expedition. Dr. Solander was returning with Sir Joseph Banks and nine others from a botanical ex-

cursion in Terra del Fuego to the ship, during extreme cold, and finding that some of the party were showing drowsiness, he warned them most forcibly of the danger of sleep—"whoever sits down will sleep, and whoever sleeps will wake no more." He himself was, nevertheless, the first to lie down, begging to be allowed to die in peace. His companions, however, roused him, and he afterwards saved the lives of others who would have succumbed to fatal sleep. Covering exposed parts with oil is a very useful protective, which Xenophon mentioned. The influence of cold weather on mortality is manifested by the larger returns of the Registrar-General when it occurs, especially if combined with wind, which, by constantly removing the stratum of air which the human body has heated, increases its cooling and depressing effects. When the temperature in London falls from 45° to 27°, it is calculated that about 400 persons perish, which constitutes a greater increase of mortality than is produced by most cholera epidemics. Bronchitis is the cause of death so excited, and in that city during other weeks which have been remarkable for heat, but 40 deaths have often occurred from that disease. It is upon the very young and very old that cold exerts its most fatal power, as the heat-producing function is less active; and to them especially should such seasonable charity as blankets, clothes, or food be supplied. The greatest natural cold—namely, 91° below zero—ever observed was in 55° N. Lat.; and India is said to present the extreme of heat—namely, 120°; so that man is capable of living within a range of 200°, which is a faculty possessed by no other animal.

The cold climates are such as lie between 55° of north and south latitudes and the poles, and the place which has the lowest annual mean—namely, 1·66°—is Melville Island. The range I have mentioned includes most of the north of Ireland and Scotland; but a bounteous Providence has sent us the Gulf Stream, which mitigates

the rigorous climate which, from the position of the island, would be ours. The diseases said to be due to intense cold are often more justly attributable to a combination of this condition with humidity; they are of the rheumatic, scrofulous, pulmonary, and diarrhœal types. In arctic regions, too, low temperature, combined with such degenerating influences as deficient light and scanty food, has stunted the races which inhabit them; but they are free from the ills (consumption included) which a faulty civilization has inflicted upon other races. As was quaintly said by a Danish writer more than a century ago of Greenland: "The temperature of the air is not unhealthful, for, if you except the scurvy and distempers of the breast, they know nothing here of the many other diseases with which other countries are plagued, and these pectoral infirmities are not so much the effect of the excessive cold as that of nasty foggish weather, which this country is very subject to."

The term "temperate climate" is usually bestowed on all those between 30° and 55° of northern and southern latitudes, and in them a wider range of temperature has been observed than in the arctic or torrid zone; for instance, the Surgeon-General of the United States tells us that at Fort Kent, a range of 129°, or from 39° to 190°, occurred in the year 1845. As an example of one of the most favoured climes in this zone, I will confine your attention to our own island.

Descriptions of the climate of Ireland are contained in the writings of the Four Masters, and concerning later periods, in those of Boate, Molyneux, and Rutty, and all seem to indicate that it has undergone no remarkable change within a period extending over many centuries. Now, as then, its principal features are the general prevalence of westerly winds, of severe easterly gales in spring, which have been complained of by almost every ancient writer, the comparative mildness of winter and

the coldness of summer, dampness at all seasons, and a generally equable temperature. The last-named condition, as I have observed, is due to its being surrounded by sea, and to the influence of the Gulf Stream, for while parts of the Continent—Prussia, for example—are annually covered with snow, and the Elbe is not unfrequently frozen, our northern lakes are scarcely ever frozen, and the myrtle blooms in the open air at Glenarm in the same latitude—namely, 55° N. Few parts of this country are more than 300 feet above the sea level, so that but about one degree of temperature is thus lost by elevation.

The superficial features of Ireland account to a great degree for the mildness and dampness of its climate, and foremost among such features must be noted the abundance of lakes, rivers, and bogs, which so plentifully yield water to the clouds by their evaporation. The vastness of the Shannon, "spreading like a sea," as the poet Spenser has it, would, in so small an island, alone account for its humidity, which, however, is not so excessive as to deserve Lord Macaulay's description, "Ireland is a marsh, saturated with the vapours of the Atlantic." The geological substrata are mainly limestone, granite, quartz, and sandstone, and they are clothed with soils of more than average fertility, except where bog (or vegetal matter carbonized by moisture—not by heat, as coal is) prevails.

The mean annual temperature may be set down at 50°, the winter average at Dublin being 41°, and the summer 61°, our city being in latitude 53° 20′ N., and 6° 17′ longitude W. In Belfast, I find the summer average is 64°, the winter 40°, or the annual mean 52°. The severity of our winter rarely sets in till after Christmas, and the amount of frost is below that of England. If our climate depended only on its latitude, and was not warmed by the Gulf Stream, the winter mean would fall to 10° instead of varying, as it does, higher than

that of Milan, and being as high as if our position was 15° nearer the equator. The warm water of this great oceanic current sometimes bears with it tropical fruits and fishes to our shores. Its proximity is, however, attended with the disadvantage, that it occasionally promotes fearful storms, the most disastrous of which was that of 1780, when 20,000 persons were destroyed on shore by the fall of houses and the rush of the winds.

The mean annual height of the barometer, the instrument which measures the pressure of the air, was for six consecutive years 30·55, 29·31, 30·13, 30·58, 30·64 29·27, and one of the highest degrees it has ever attained was 31·5, and the lowest 27·5.

The amount of rain varies in different parts of the island, being greatest along the Atlantic shores, owing to the influence of the ocean and to the mountainous ranges which run close to the sea; there was, for instance, at Collooney, near Sligo, 42 inches of rainfall, while it was but 21 in the central district, Armagh. At Belfast the annual average is about 35 inches, at Dublin 30—greatest in October, least in February, according to that learned meteorologist, the Vice-Provost of Trinity College, to whose writings I am indebted for nearly all the facts I give you relating to our climate. The number of wet days is much greater in this country than in England, as is also the rainfall, which at London averages but 21 inches, and these circumstances have originated the prevailing, though to a certain extent exaggerated, impression of the humidity of our atmosphere. That it does not shorten life appears from the fact that the number of persons over 100 years of age is, in proportion to the populations, five times as great in Ireland as England, and the greatest longevity has been observed in Connaught, the wettest of the provinces. If 100 be allowed to represent the utmost saturation of the air, 88 is the average for Ireland, 92 for November

and December, and on many days it attains the enormous per-centage of 94°.

Of all regions of the earth the inter-tropical are the most humid ; but as we go towards the poles the number of wet days increases, although the actual amount of rainfall decreases. Perhaps the extremes in this respect over the world are presented by Sierra Leone, where the mean fall is 189 inches, and the edge of Peru sloping to the Pacific, where rain was never known to fall. With us the south-west is well known to be most pluvious, and in one year the rainfall at Cahirciveen was 59 inches, while it was but 21 in Portarlington. In the former place the difference between the highest day temperature and lowest night temperature is least of all inland, and in the latter it is the greatest. In estimating the fitness of any place as a residence, especially for invalids, the number of rainy days is a more important factor ; for instance, as Dr. Madden, in his recent able book on "Continental Climates," tells us, the rainfall at Cannes, in the south of France, is five inches higher than at London, yet the rainy days average 178 in the latter, and but 52 in the delightful watering place I have mentioned. That climate which allows of the greatest amount of out-door exercise will be always the best for the prevention and alleviation of consumption.

Dew is a deposit of atmospheric vapour, the effects of which are popularly and with justice dreaded. It falls when the capacity of the air to contain moisture is lessened, by its temperature being lowered at the departure of the sun, and it therefore increases from shortly after sunset to midnight. In seaside and lake districts it is greatest, and, on the contrary, the phenomena is never observed in such arid deserts as Sahara.

Winds or currents of air produced by changes of temperature are either variable or constant, of which the trade wind, which carries a cold current from the poles

towards the equator, is an example. Some winds—the monsoon, for instance—are periodical. The winds which we term easterly do not blow from any considerable distance due east, but are rather streams of polar wind which, according to the late Admiral Fitzroy, are deflected by the Danish, Dutch, and French shores, and thereby rendered easterly to our coast. But inasmuch as these shores are very flat, I venture to suggest that the rotation of the earth is a more obvious cause to assign for the deflection. Be this as it may, however, there are few of us who have not experienced the disagreeable effects of these gales upon body and mind. Winds are of infinite service in renewing the air which in towns is rapidly polluted, and long-continued calms have preceded the outbreak of many epidemics, as has been observed ever since the plague of London.

The malady which, from its frequency, will best illustrate the effects of moderate climate, is consumption. Prof. Henessy, F.R.S., has shown that in districts with an average temperature of 49°, deaths by consumption are two and a-half times as frequent as in counties, such as Kerry and west Cork, where the annual mean is about 51·5°, or $2\frac{1}{2}$° higher. It is worthy of note that this latter region is that which the late Prof. Edward Forbes proved to possess a mountain flora of the same kind as exists on the hills of Spain and Portugal. The mean annual temperature is $3\frac{1}{2}$° higher in the south than the north, and and 2° higher along the western than the eastern coast. The cause of this difference is the Gulf Stream, which begins to exert its genial influence about September. For this reason I have found that pleasant watering place, Salthill, Galway, most agreeable late in the season, when all the east coast places had been deserted. Light is another physical agent which influences much the production of consumption and other scrofulous diseases. Light promotes oxidation, and elevated places may in this way derive some of their

preventive power against the disease; and it is certain that development of good red blood cannot occur in dungeons or other places where cheering light is denied, no more than can the green sap of plants be produced, or a rose have strength enough to flower. Sun-blinds are too often down to save carpets, while they are injuring health. Darkness may promote the unnatural heaping of fat into the tissues of an ox, but this is by no means an evidence that healthful conditions have been observed. This reminds me of the way gourmands in Italy feed ortolans, as described in Chief Justice Whiteside's book. The birds feed naturally at sunrise only; while they are cooped in dark rooms, a bright light is suddenly thrown on them several times a day, and they are thus entrapped into a multiplication of their meals.

That profound philosopher, Sir Humphry Davy, attributes many of the characteristics of the British nation to its climate: "Of all the climates of Europe, England seems to me to be the most fitted for activity of mind, and the least suited to repose. The alternations of a climate so various and rapid, constantly awaken new sensations, and the changes of the sky from dryness to moisture, from the blue ethereal to cloudiness and fogs, seem to keep the nervous system in a constant state of excitement. In the changeful and tumultuous atmosphere of England to be tranquil is a labour, and employment is necessary to ward off the attacks of *ennui*. The English nation is pre-eminently active, and the natives of no other country follow their object with so much force, fire, and constancy." The same frequent variations, which make "the weather" so constant a topic of conversation, may be remarked in this climate, although the difference between the winter and summer means is but 20°, or on the coast but 14°, the smallest in Europe; whereas in other countries—European Russia, for instance—it is 40°. From a consideration of the climate of the British Isles, it might be inferred that they should have

the lowest mortality among European countries, and such is the fact, as exhibited in the following most instructive table, constructed by the Rev. Dr. Lloyd:

Countries.	Excess of Summer over 50°.	Defect of Winter under 50°.	Deaths per 1,000.
Italy, Turkey ...	+ 25° ...	...	33
France, Austria ...	+ 18° ...	...	25
Central Germany ...	+ 15° ...	...	22
British Islands ...	+ 12° ...	— 13°	21
Belgium	...	— 16°	23
Holland	...	— 18°	26
Prussia	...	— 22°	28
Russia	...	— 36°	37

Epidemics in the hotter, and pulmonary diseases in the colder, mainly produce these striking differences. Hot climates positively lead to mental lethargy, and some of the most promising students I have ever known here, on proceeding to India, become too indolent to observe or record the numerous facts in medicine or natural history which that vast country affords.

I have not time to discuss the climates of special parts of Ireland, nor the suitableness of many of our watering-places as residences for invalids; but I am afraid that the reason which Dr. Rutty assigned one hundred years ago for their neglect may still have force. He longed "that our patients could be persuaded to lay aside their unrighteous prejudices against the productions of their own country." In the very elaborate work of Dr. Knox, Poor Law Inspector, all the Irish watering-places are fully described. Many of them—Donegal and Swanlinbar, for instance—have been once much frequented, and were really serviceable in many diseases, as the analyses of the waters by Sir Robert Kane would convince one; but the tide of fashion has flowed elsewhere, and much enterprise and tact would be required to attract it again. I have seen many persons who have returned from the spas of Lisdoonvarna full of enthu-

siasm upon the efficacy and comforts of a sojourn there. Our great chemist, Dr. Apjohn, has shown that iron and sulphur exist in each of the springs in most suitable proportions. During a prolonged tour some years since through the Continental watering-places, I saw nothing with which we could not compete at home as regards scenic effect, and I am a firm believer in the feasibility of forming by chemical skill factitious waters, identical in composition and quite as useful as those which issue from the earth. Waters identical with the natural ones have been made by digesting some of the soils of the Bohemian springs in distilled water. The adjuncts of baths, drinking-fountains, musical bands, promenades, and assembly and reading-rooms, could be easily accomplished, and if the scheme was connected with some large hotel conducted by a company, it would be, I feel sure, pecuniarly successful. Those whose means or leisure would not allow of a Continental sojourn could then attain perhaps all its advantages near home. For somewhat similar objects the Crystal Sanatarium Company was formed in London, and proposes to cover in with glass a large area of ground (140 acres), and to preserve therein an equable temperature, similar to Madeira; to build residences having communication with the grounds so enclosed, and to lay out the interior in the most attractive form of landscape gardening, with the fruits and foliage suitable to a climate like Madeira; and the project has met support from fifty-seven of the most eminent physicians and surgeons of London, who declare, "we should feel it our duty to recommend many of our patients to be domiciled under its roof, during our attendance upon such cases as affections of the heart and lungs, consumption, asthma, and bronchitis, and generally in cases of invalids and convalescents, where air and exercise are necessary, with an uniform degree of temperature, independent of weather or season." Forgetfulnesss of his bodily, and perhaps mental ills, is

the strongest inducement held out to the patient cogitating a foreign tour by Dr. Madden, who quotes Cowper's apt lines depicting the anxious thoughts which afflict valetudinarians :

> "We next inquire, but softly and by stealth,
> Like conservators of the public health,
> Of epidemic throats, if such there are,
> And coughs, and rheums, and phthisic, and catarrh."

But such anxieties and depressing feelings are, I think, nearly always individual peculiarities. The unwholesome arrangements of many Continental hotels and lodging-houses render it safer for invalids who cannot afford the best appointed to remain in their own country.

In nearly every ancient and modern city of Europe the western extremity has been selected by the opulent classes for its salubrity, which is owing to the following fact: westerly winds prevail, and the pure air of the surrounding country is thus blown over the neighbourhood, instead of the air charged with city emanations, which are so injurious. Dublin is an exception to this rule, because from proximity to the sea, and the ascending currents which sea breezes give rise to, carrying off smoke and impurities, the southern and south-eastern parts are more desirable residences. The position of the chemical factories in the eastern end of the city is less injurious than if they were in the west, when their vapours would blow over the best parts of the city. The substratum consists of gravel and strong yellow clay in the lower, and calp limestone in the higher levels. It is exposed on its eastern side to the sea, but until the sewage be carried further out this is not a condition of unmixed salubrity. The mean rainfall in the year is twenty-nine inches. The mountains are sufficiently distant and eastward to remove the rainy and breezeless characters of a mountainous climate. Much of the eastern part of the town stands on land reclaimed from the sea and still below its level. Drainage is here

necessarily imperfect and cholera has prevailed in excess of other districts. Until, however, the registration and sanitary inspection of the city will be perfected and particularized, we shall be scarcely able to determine the relative salubrity of various parts of the city, to map out their prevailing diseases, and thus bring our hygienic agencies to bear on them for the purpose of reducing the causes which render a disease more frequent or fatal in one place than another.

I will now mention very briefly the diseases which prevail in each of the four seasons. Inflammations of the breathing organs, rheumatism, dysentery, and scarlet fever, occur in greatest frequency during the winter three months, and they render the death-rate greater in this than in any other quarter, especially among very young or very old people. During spring much the same diseases prevail, with the addition of croup and hooping-cough, and it is the most fatal period for consumptive patients, the east wind frequently ending the work of destruction which winter began. In summer, bowel diseases, typhus fever, and small-pox swell the bills of mortality; and lastly, autumn has always been regarded the most fatal of all the seasons ever since the time of Tertullian, who calls it *tentator valetudinum*. The reason of this is chiefly that the climatic conditions are variable, suddenly changing from a summer to a wintry character, and the diseases most formidable in each may combine in autumn to render it insalubrious. The deaths by consumption and some other lung diseases are least in this quarter. For many years in England the comparative number of deaths in each quarter has been about as follows:

January, February, March	...	25 per 1,000.
April, May, June	...	22 ,,
July, August, September	...	20 ,,
October, November, December	...	21 ,,

A few remarks on acclimation, or the process man undergoes in becoming naturalized to any new clime, may not be inappropriate. Our wonderful adaptability to the most diverse conditions of climate, food, and other physical circumstances is indeed one of the peculiarities of our kind, distinguishing us from other animals, and it is remarkable that the creature which approaches nearest to man's physical structure is of all animals less able to bear such variations. It has been most erroneously asserted that a race in colonizing a new country must necessarily undergo degeneration, but such a statement is disproved by numerous facts in the world's history; for instance, we must remember that the inhabitants of the British Isles are not aboriginal. The secret of successful colonization is that such changes shall be made as will make the mode of life closely conform with that of the original inhabitants; but under the heads of food, exercise, and clothing, I shall have to bring before you most of the principles which should guide those who, in following the tide of emigration, exchange a cold or temperate clime for a hot one, or, as is more rarely the case, a hot one for a cold. There is a limit to acclimation, and indeed our best Indian hygienists tell us that our troops in that empire never become acclimated, so that the polity of leaving regiments but three or four years on that service cannot be doubted.

I have left myself but a few moments for the discussion of the influence of our climate upon the prevalence of disease, so that I shall be compelled to postpone many remarks which crowd upon me to future occasions when I shall have the pleasure of meeting you. The materials for a medical history of Ireland in ancient times are scanty. In speaking of the diseases of his times, Cambrensis makes use of a very dubious expression: *Morbidos enim homines præter moribundos paucos invenies*, from which some might draw the inference, I feel sure unjust, that the doctors of that day made short work of

their patients. Campion, in his "History of Ireland," tells us, "Inhabitants, especially newly come, are subject to distillations, rheums, and fluxes, for remedy whereof they use an ordinary drink of aqua vitæ, so qualified in the making, that it drieth more and inflameth less than other hot confections. The air is wholesome—not altogether so clear and subtile as ours of England." With so much moisture and abundant vegetal remains, it has always been a matter of surprise that malarious or aguish diseases did not infest Ireland; but the mildness of the climate seems to account for the exemption, as a high temperature is needed for the development of these poisons. The numerous mosses and other small plants may also decompose the vapours from the bogs. I may mention that human bodies are sometimes found preserved in peat by a kind of tanning, and the astringency of the bog-water may also go some way in accounting for the remarkable absence of reptiles.

When speaking of the food of our peasantry, I shall take occasion to express an opinion that the great frequency of dyspeptic ailments could be partly attributed to its unvaried innutritious and bulky nature, but at the same time I think that the dampness of the climate also predisposes powerfully by promoting internal congestions. A similar remark has been made of the effects of a cold damp winter and scorching summer upon the inhabitants of Canada and the northern states of America, where, however, the rapid and unwholesome modes of eating have much to do with the causation of such complaints, as well as of their white-blooded aspects. I must, however, defer some further remarks on this subject till Thursday.

LECTURE VI.

FOOD — PHYSIOLOGICAL PURPOSES — TISSUE-MAKING — FOOD — METHODS OF PREPARING AND PRESERVING.

THE two necessaries which I have heretofore considered, air and water, should be within the reach of every citizen, however poor, and it becomes the duty of the authorities to provide them both in plenty and purity. Of food, however, the same cannot be said, for circumstances will always produce a multitude of varieties in the supply to each rank, and when the educator has taught the general principles of alimentation, and the legislator has secured an immunity from adulteration, the question becomes one of individual duty, and need not be considered further by us while discussing questions of public health. Such considerations must form my excuse for the brevity with which I propose to treat the extensive and important subject of food.

In the physical life of man there is scarcely such a thing as rest, the numberless organs and tissues of which his frame consists undergoing perpetual change, and in the exercise of the function of each some part of it is destroyed. Thus, we cannot think, feel, or move, without wasting some proportion, great or small according to the energy of the act, of the brain, nerves, or muscles, the apparatuses of these endowments. The wasted brain, nerve, muscles, or other substance resulting from the exercise of any of our numerous vital processes cannot remain in its original situation, where it would be not only useless dross, but also obstructive and injurious. Such old material is then being daily removed from our bodies to the average amount of three or four pounds; and that an equal quantity of new should be substituted, is the first

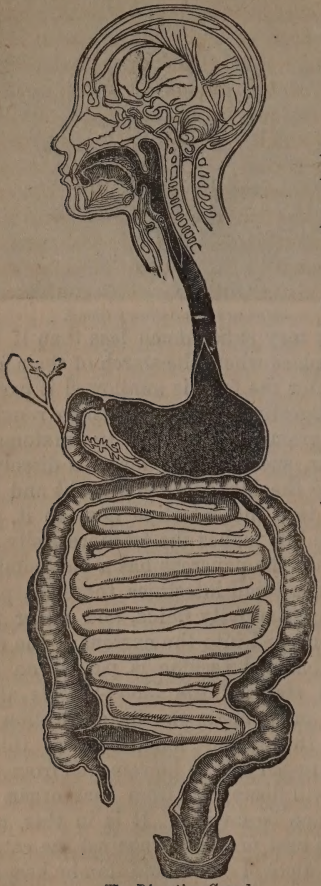
principle of alimentation. To express it in commercial language, the income must be equal to the expenditure, and for each the amount exchanged is not far below a ton and a-half. This tissue change is so complete, that not a particle of our present body will be ours some short time hence, and we will be, as I have lately seen it phrased, like the knife which, after having had several new blades, and at least one new handle, was the same old knife to its owner—we are, in fact, constantly "moulting."

As the destructive changes are usually from the solid to the liquid, or the liquid to the gaseous state, a constant abstraction of heat must result, and the colder air about is constantly depriving us of heat. Food, we will see, is then necessary to keep the body at the uniform temperature of 100°, which it possesses, especially in countries where the average temperature is very low. The means for liberating heat which Nature almost exclusively employs, is combustion, and in our bodies it is proceeding constantly and extensively. Its two requirements are fuel and oxygen, and these are supplied by a considerable portion of the food we consume, and by the air we breathe. It may interest you if I very briefly sketch the process of digestion, by which food is prepared for the nourishment of the tissues. After it is introduced by the hand into the mouth, the food is divided and bruised by the teeth, and at the same time it is mixed with saliva, a fluid which softens and lubricates the mass before being swallowed. This fluid has, moreover, the more important property of converting the starch of our food (which in arrowroot, rice, or potatoes, constitute almost their entire value) into sugar—not the common sweet kind, but what is known as grape sugar. The structure of the glands which pour out saliva is astonishing, as you may judge from this representation of one of their minute portions displayed by the microscope. These glands pour out $2\frac{1}{2}$ pints of saliva,

a good deal of which is swallowed after the food, so that it acts upon it in the stomach. People who get the bad habit of "bolting," their food, and lunatics who are compelled to be fed with a tube carried to the stomach, in this way may suffer much less than if the mouth were the only place where the starch of their food could be digested. After the food is swallowed it passes through the tortuous digestive passages, which are roughly represented in the diagram on next page. In the stomach the albuminous matter, such as lean meat, is dissolved and taken at once into the blood, while the fat and indigestible parts pass into the intestine next to it, the duodenum. Here the bile makes the fat more easily absorbed, and the fluid of the pancreas has a very similar function. All along the small intestines there are projections which suck up the fatty fluids, and under the name of chyle it is conveyed into the current of the circulation, while the exhausted residue is passed on for expulsion. The full state of the blood-vessels after taking food is quite antagonistic to the absorption of contagious poisons; thus, after food, it takes thirty minutes for an easily tested salt to be removed from the stomach, whereas it will disappear from that organ in one minute if the person be fasting. It is in this way that a good meal is the best preventive against the catching of epidemics, and alcohol acts in addition by keeping up the action of the heart and dissipating fear.

Structure of a Salivary Gland.

According, therefore, to the two purposes which food



The Digestive Canal.

fulfils, we may consider it under two divisions—1, tissu

making; and 2, heat-making. Of water I have, perhaps, said enough in a previous lecture, but you must remember that it forms the bulk of many foods, and it is related that Mahomet Ali would eat his forty-pound melon after the substantials of his dinner were disposed of. Besides these materials, our tissues are built out of a great variety of salts (which, although belonging to the mineral kingdom, are served to us by the vegetal and animal), and two principal organic substances—fat, and that which, from its close likeness to that typical food white of egg, we call albuminoid. The physical power of individuals is proportional to the amount of those substances which his system can utilize. The more essential mineral foods are common salt, salts of alkalies, and lime, with phosphoric and the vegetal acids, sulphur, and iron, and their importance is well expressed by Dr. Lankester: "Persons who prepare our food—cooks in the kitchen, ladies who superintend cooks, and order dinners for large families, and people who consume food from day to day, never think of asking whether food contains the right proportions of these ingredients to secure health. Yet, without these, babies get rickets, young ladies acquire crooked spines, fathers get gouty, and mothers get palpitations; and they do not, however, think of ascribing these things to the food which has deprived them of the proper constituents of their blood."

The chief physical purpose which common salt subserves is to alter the density of fluids, so that when two are separated by the animal membranes, the denser and the lighter will interchange through it till they both become of the same specific gravity. On this principle depends the taking up or casting off of every liquid which passes into or from the system. The presence of this salt is also indispensable, for some reason we are ignorant of, when growth or cell-forming is taking place. Its abundance in the tissue of the inflamed lung will occur to the minds of my professional hearers in illus-

tration. Chloride of sodium is believed also to supply soda for the bile, and hydrochloric acid for the gastric juice, by decomposition, and if that acid be the solvent of albumen in our stomachs, its powers are quadrupled by admixture with the salt itself. The uses of this substance being then so apparent, you will not be surprised to hear that animals pine when it is excluded from their food, as was conclusively proved by Boussingault, in the case of cattle. Grazing land has frequently improved after having been overflown by the sea. In Abyssinia the prevalence of tapeworm among the inhabitants may have some connexion with the difficulty of obtaining salt, as well as with their disgusting habit of eating raw beef. In that country, we are told, that persons of the higher rank carry in their pocket a piece of salt, which, as a mark of especial favour, they offer to a stranger to lick. It may be said that here the remedy grows beside the disease, for kousso, the most efficient agent in treating tapeworm, is indigenous to Abyssinia. Muscle-juice and yolk-of-egg are perhaps the only animal matters destitute of common salt, and hence their insipidity. The amount in the human body is about four ounces, not subject to increase by introducing more, for the surplus will be rapidly rejected from the blood.

The alkaline phosphates abound in our blood-cells and muscle-juice, and are supplied us in the cereal grains, potatoes, and flesh meat, which has not been too thoroughly bled or salted. Vegetables by being boiled lose these alkaline salts and those of the organic acids, and hence the use in soup of the water in which they are cooked, or of such uncooked vegetables as celery, lettuce, cresses, or radishes, is most wholesome. They act as solvents of many constituents of the blood, even so insoluble a substance as phosphate of lime, which otherwise could not be carried to the bones. The phosphoric acid is probably utilized as a solvent in the gastric juice, and the vegetal acids being converted into carbonic,

alkalies, or their carbonates, are set free in the blood, which, unless constantly alkaline, could not fulfil its duties as the great medium of oxidation or combustion. Phosphate of soda is believed by Liebig to have the all-important property of absorbing carbonic acid, according as it is evolved from the dying tissues throughout the body, and then conveying it to the lungs, where, on coming in contact with air, it at once resigns it for dismissal. I will return to the subject of these salts when speaking of scorbutic diseases due to dietic errors.

The lime salts—phosphates and carbonates—exist to the amount of seven pounds in each of us, especially in our bones, which they render a hard yet elastic framework. During infancy and childhood, when the bones are hardening, they are above all necessary, and therefore abound in milk and in bread, and if these natural foods are not plentifully supplied, rickets and other scrofulous diseases will assuredly follow. Wheat and other grain crops exhaust the soil of phosphates and lime, and if these substances are not replenished by manuring, it will become incapable of producing such food. Yet, although this is one of the truths modern agriculture has taught us, we sadly disregard it in casting off in the sewage, and thence to the sea, these salts when excreted from our bodies. In many American settlements, as it is easier to migrate to a new district than to carry phosphates to the old one, which by their abstraction is rendered barren, the most extensive changes are occurring; and it is probable that the destruction and desertion of the cities of old was due to similar causes. I may allude to the suggestive fact that nearly all the phosphates we are at present using are but the excrement of reptiles who lived thousands of years since, 40,000 tons of which, known as coprolites, have been, within the fifteen years succeeding their discovery, procured from Cambridgeshire alone. It is not known positively from what source we derive the

phosphorus, which seems a necessary constituent of our brains, but it is an interesting fact that its amount is proportional to the mental activity of each individual—scanty in idiots, infants, and extremely old people, and abundant at mature age; and as every thought burns, and discharges in the secretions as phosphates, a certain quantity, we have a ready method of estimating the amount of brain-work. Dr. H. Kennedy has with great ingenuity argued that it is possible to influence the intellect by the food, and when we see that the muscular system can be increased by the diet suited to it—as in "training"—there can be no doubt that the proper food of the brain might be advantageously given to train thinkers.

About one-third of an ounce of iron exists in the human body, or just enough, if extracted from the remains, to make a commemoration medal or mourning ring for the dearest relative, as is said to have been done by some ingenious Frenchman. The chief function of this metal seems to be to carry oxygen, for which it has so powerful an affinity, from the lungs in the arterial blood throughout the entire body. Its deficiency makes itself known by the peculiar pale or greenish hue often seen in females, and indeed sometimes in males, as noted by Shakespeare, who assigns a cause frequent but preventible: "Their drink doth so overcool their blood, and making many fish-meals, that they fall into a kind of male green-sickness." Every hospital physician knows how easily such cases are controlled by the remedy which chemistry suggests.

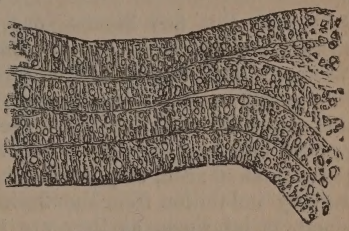
What I have next to speak of are more evidently substantial foods than these meagre stuffs which, with the exception of common salt, are taken without our being aware of it. The British is the most flesh-eating, because the most laborious, nation in the civilized world—also meat being above all nutritive and digestible, can be most rapidly ingested, for this is another characteristic

of the Britisher, with whom many a meal is despatched "between two entries in the merchant's leger."

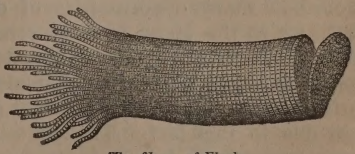
The importation of foreign animal food is becoming much larger year by year:

	1853.	1863.
Beasts imported .	125,253 .	150,898
Sheep and lambs .	230,037 .	430,788

It has been calculated that London alone annually consumes some 6,000 oxen, 29,000 calves, 35,000 pigs, and over 1,500,000 sheep and lambs. We are by meat supplied with musculin—a substance identical with our flesh—with most of the salts which I have shown are requisite for nutrition, and with fat. This fat, as I shall explain hereafter, is most valuable, but is in great and hurtful excess in the meat supplied from stall-fed cattle, which get into a state of what we doctors call "fatty degeneration." Even the muscles are "marbled" with fat, and the microscope shows how different the fibres are from those of healthy muscle seen in the adjoining illustration. The flesh of animals which have been allowed free exercise is far more lean and digestible. It consists of particles arranged in threads or in discs, according to different microscopists, and in this figure both views, which are readily reconcilable, are represented. The gastric juice soon breaks muscle down into it ultimate particles. About one-fourth of the weight



Flesh-fibres spoiled by Fat.



The fibres of Flesh.

of the carcase of the ox is solid flesh, and about one-fifth blood and juices, or fluid flesh, which, by the modes of slaughtering now in practice, are almost wholly wasted, or rather cast into our sewers to putrefy and poison the atmosphere. Some years ago I advocated methods of killing cattle without bleeding, and I will here, with your permission, briefly recapitulate their advantages: 1. Blood and flesh are identical in chemical composition, as is evident from the following analyses:

	Dry ox-blood.	Dry ox-flesh.
Carbon	54·35	54·12
Hydrogen	7·50	7·89
Nitrogen	15·76	15·67
Oxygen	22·39	22·32

And from this fact Pereira, one of the most reliable writers on diet, allows that their nutritive value is equal. Very good articles of food are prepared from blood, and they would become favourite ones if we were convinced that that fluid were collected in so cleanly a way as to prevent offal getting mixed with it. 2. The removal of phosphates of soda, sulphates, iron, and of the potash salts by imbibition from the flesh with the last flowing blood, is injurious, as they are nutritive materials of vital importance, and one of the best preventives of scurvy is underdone meat, or that in which some blood remains, as my former pupil, Dr. Walker, the Naturalist and Surgeon to Sir Leopold M'Clintock's Arctic expedition, had many opportunities of observing. 3. Meat from which the blood is most completely extracted, as thoroughly bled veal, is acid and unwholesome. All game, fish, and some other animals are but slightly deprived of blood, and their pleasant and distinctive tastes are due to this fact. The equestrian people of the American pampas kill their oxen in a way which does not extract the blood; and upon this flesh, usually dried in the sun, and constituting their sole diet, they attain

the acme of muscular vigour. Contrast with this the well-known destruction of an English regiment from having been compelled to live exclusively on the flesh of tame cattle butchered in the ordinary way. The following modes of killing would retain the blood, and be likewise as rapid and painless as possible: 1. Compressing the lungs with air, as was patented by Dr. Carson—or with water, as practised at my suggestion. This preparation of a sheep's chest will show how readily the fluid can be forced into the cavity outside the lung by a sharp-pointed tube thrust in between the fifth and sixth ribs, and to which is attached a large elastic bag. 2. By blowing air into the jugular vein, the way horses are often destroyed on the hunting-field after an accident. 3. By thrusting a knife into that part of the brain known as the fourth ventricle; or 4, as practised in the abattoirs of Paris, dividing the spinal marrow in the neck—a most painless way; and this is not only a humane consideration, but a selfish one, for the meat of animals which have suffered agony is hurtful—even poisonous.

Meat killed in the first of these ways, and with blood retained was more delicious, and kept as long as that prepared in the ordinary way. To diminish the acidity of ordinary meat, it requires to be kept some time before being used, or until it becomes alkaline from incipient decomposition evolving ammonia. Now, it is very hard to determine how far this alkaline putrescence should proceed, and although the gastric juice has undoubtedly antiseptic properties, food may be introduced into the system in a very unfit state. Meat also loses in weight and substance by being kept; and to avoid pecuniary loss, it is often sold and dressed in a condition most injurious or even poisonous. The blood is an alkaline fluid, and if retained in the flesh would neutralize its acidity, and thus render it fit for food much sooner. The muscles of animals stiffen a few hours after death, which is probably mainly owing to the blood

becoming solid within the vessels, for it scarcely occurs in the carcase which has been bled. It is well to wait till this stiffening has disappeared, for the meat is then certainly more tender and digestible. It has been proved, however, that no method of slaughtering will entirely remove all trace of blood from animals, for the microscope or chemical analysis will still discover it. Any prohibition, therefore, against partaking of blood will be virtually a prohibition against eating flesh at all. As well might Shylock have endeavoured to remove his pound of flesh without bloodshed, as might the butcher try to drain absolutely all the blood of the animals he slaughters.

The distinguished philosopher, who presided at the scientific meeting at which I brought forward my views, concurred with me, and said the present mode of killing animals certainly abstracted a large amount of blood and other nutritious fluids which were much better left in the body. The old methods of slaughtering were most accurately described in the Pentateuch, and there is no doubt that it was hygienic considerations influenced Moses in forbidding the use of blood. But the prohibition, most useful in warm climates, was not necessary in colder latitudes.

A member present having expressed a wish to know how the meat tasted when cooked, as the proof of the pudding was the eating, the editor of one of our leading journals said, in answer to this query, that he had a shoulder of mutton lately dressed, the animal having been killed in the way described, two days before, and he could only say that he had never tasted anything so delicious in the shape of mutton in his life. Animals smothered or drowned may sometimes be used with impunity, which is most important, as great numbers of sheep and cattle are thus annually lost. Strangling or drowning is not a very rapid form of death, as it usually occupies about five minutes, and during that time the

blood is driven to the lungs in great quantity, but is not freed from carbonic acid; the flesh is consequently very dark and apt to putrefy, but it could be saved by the method of injection I have alluded to, for in this way the dark blood can be washed out, and the flesh can be oxygenated and rendered bright in colour by the injection of saline solutions. Plunging the carcase in hot water also changes the colour from the dark venous to the arterial hue. All the plans of slaughtering I have described are, however, essentially different from suffocation, as the bright red tint of the meat proves.

Meat will always be a high-priced food, and remembering its great nutritive value, I feel strongly that the beef introduced lately into this country from South America and Australia is a boon to the poor, who cannot purchase home-killed meat. At once I must explain that I do not consider it as palatable or digestible as butcher's meat; but in proportion to the nutriment each contains, this Monte Video dried beef is at least five times as cheap. Its composition, and that of an average specimen of corned beef, are shown by these analyses I have made; and the quantities in fresh beef, determined by Moleschott, and those of the South American meat, according to Prof. Cameron, are added for sake of comparison:

	Monte Video Beef.	Corned Beef.	Fresh Beef.	South American Beef.
Water	17·94	62·08	73·4	40
Ash	21·66	9·97	1·6	12
Fat	3·05	21·07	2·87	21
Nitrogenized substance	57·35*	6·88†	20·30	27
	100·00	100·00		100

The very different amount of fat in each is not aston-

* Containing 7·67 nitrogen = 49·80 musculin.
† „ 0·49 „ = 3·18 „

ishing when it is remembered that one animal enjoyed free exercise, the other was stall-fed.

It is well suited to the making of soup, some of which I exhibit you, and eats right well in the form of an Irish stew. It is used extensively in Scotland, but has been sold to a small extent in this country, for its preparation requires some little culinary skill, which is possessed in a less degree by our poor than by any people in the civilized world. I am glad to hear that efforts are being made to introduce it now into poorhouse dietaries. It would be most desirable that some of the meat which is wasted in these countries, and to a great amount also in the Falkland Islands, should be boiled down to an extract, which of all foods is the most powerfully restorative. In March, 1864, one of our most intelligent young licentiates was sent out to Monte Video to cure some of the beef by Prof. Morgan's patented plan, which I shall presently allude to; and several hundred bullocks' carcases so prepared have been since landed in this country. As this process will render it unnecessary to cut the meat into strips or to dry it, which has been done heretofore, I feel certain we shall have good salt beef at one-third its present price. The old plan of salting—namely, placing salt or brine around large masses of the meat—robs it of much muscle-juice, phosphate of potash, albumen, lactic acid—a most important material for the breathing process—and other soluble and flavouring contituents, substituting merely common salt.

Salted meat is objectionable for the following reasons: its soluble salts are extracted with the brine, and as it must be steeped in water before being used, much of the soluble nutritive matter is afterwards dissolved out, and the covering of the fibres of the meat is so hardened that it takes a long time to be digested, and often disagrees with the stomach. Of such old, indigestible, oversalted meat, two of the best naval authorities remark

that it "has no more nutrition than saw-dust or the bark of a tree," and that "ornaments may be cut out of the meat, resisting the knife like wood." If our flesh is to be built out of that of other animals, which is pre-precisely similar in composition, it is doing wrong to take any of its constituents away; and Liebeg tells us: "It is certain, moreover, that the health of a man cannot be permanently supported by means of salted meat if the quantity be not greatly increased, inasmuch as it cannot perfectly replace, by the substances it contains, those parts of the body which have been expelled in consequence of change of matter, nor can it preserve in its normal state the fluid distributed in every part of the body—namely, the juices of the flesh. A change in the quality of the gastric juice, and consequently in the products of the digestive process, must be regarded an an inevitable result of the long-continued use of salt meat."

Now, the brine which is thrown away contains probably one-third of the nutritive materials of the meat, and it has latterly been proposed to remove the salt by dialysis, and to dry down the juice into meat extract, or use it as soup. About 60,000 gallons of brine are wasted annually in the curing establishments of Glasgow alone, and as two gallons produce as much extract as 20 pounds of lean beef, the loss must be equal to 200 tons of meat, value for at least £12,000. In America the waste is still more enormous, for in eight of the states 4,000,000 pigs were slaughtered and cured last year. The separation can be effected by putting the brine in skins and placing these in water, which dissolves out all the salt; and in the same way salt meat may be reconverted into fresh.

Prof. Morgan's plan of introducing the preserving fluid along the course of the circulation has the evident advantages of retaining all the salts and juices of the flesh, and of only adding as much salt as is necessary

for preservation. His process is as follows:—The animal being killed in the usual way, by a blow on the head, is turned on the back, the chest and heart cavity opened, and one cut is made into the right chambers of the heart, another into the left, and the animal being turned on the left side, the blood runs out. A pipe with a stop-cock and coupling at the upper end is now fixed in the cut into the left ventricle, and up the main vessel or aorta, and a cord is stoutly tied round it and the pulmonary artery. From the outer end a tube of india-rubber or other material, three-quarters of an inch in diameter, and eighteen or twenty feet long, leads to a tank raised the height of the tube; ordinary brine with a little nitre is let on, "it directly (under fifteen seconds in most cases) rushes out at the incision made either in the right auricle or ventricle before mentioned. About five gallons will suffice. This clears the smaller vessels for the next stage, which is the essential one. The brine so used can be recovered if desired by adding a little old brine and heating. The materials to be ultimately used are now put into the tank, taking care that they are strained, and a stout clip or clamp is put on the incision in the right side of the heart. The fluid is then turned on, and directly makes its way to the right side, as before; but its exit being now prevented, and its admission into the smaller vessels being secured by the first process of clearing these vessels, as mentioned, the fluid, by the pressure and the capillary attraction of minute vessels and muscular fibre, percolates through every particle of the animal, and can be seen at the moment diffusing itself in any part by making incisions in the hide, horn, bone, and flesh, or any other parts. The quantity I use," says Prof. Morgan, "is about one gallon of brine to the cwt., a quarter to half a pound of nitre, two pounds of sugar, a little spice, sauce, &c., to taste; also half an ounce of the mono-phosphoric acid, which, having the power of coagulating albumen and

forming a compound with it, retains this very desirable element in the flesh, and gives an extra supply of phosphoric acid, which is of course at present denied the sailor, as above stated. The use of boiling brine in the second stage I also advocate, as it coagulates the albumen, or gives a set (as it is called by cooks) to the meat. It is needless to remark that the entire animal is cured almost instantaneously."

The animal can in a few hours be cut up into the usual eight-pound navy pieces, and casked in the usual way, or can be dried. It will be seen that nothing is abstracted from the meat, but salt is added, and sugar, lime-juice, or mono-phosphoric acid, which are eminently anti-scorbutic; spices, sauces, or any other flavouring agents; various medicines, such as iron, which is contained in proper doses in this ham, although imperceptible to the taste, can be thus readily introduced. The albumen of the meat can be solidified either by the introduction of phosphoric acid or by infiltrating boiling brine. The practical advantages of the method seem to be, the nominal cost of the fluid, it can be readily learned by an unpractised hand, no expensive machinery is required, the whole operations take but about six minutes, and the cure is so rapidly accomplished that it might be adopted in the warmest weather, even at any tropical port where a ship might touch, and thus provide herself with wholesome provisions. It is economical, as meat is cheaper in summer months, as well as more juicy from the grass-feeding, and the market prices are now raised by the need there is of buying so many animals together. Hide, skins, and every part of the animal, even to the tip of the tail, are preserved, as the fluid follows exactly the course of the circulation. The only step in the process I do not approve of is that of washing out the blood and other juices, which I have argued are nutritive, and in no way objectionable, and its omission would not in any degree interfere with the

efficacy of Prof. Morgan's admirable process, which I am happy to state is in a fair way of being adopted by the governments of this and other countries, and has been extensively carried out by several wholesale curers. A similar method has been for many years adopted for the preservation of subjects for the dissecting-room. A company has been formed for the curing of South American beef and mutton by Morgan's process, and it is superintended on the spot by one of our licentiates. It is said there are 22,000,000 of cattle, and 35,000,000 of sheep in the River Plate district, and many thousand tons of this meat has been heretofore "jerked," and sold for feeding the negro population. The new method will quickly supersede this plan, and already some 500,000 lbs. have been sold in these countries at 3d. or 4d. a lb. The carcases I have seen were certainly those of most healthy animals, plagues and distempers having no hold on these grass-fed and almost wild cattle. In a report to parliament, the British Minister, Mr. Ford, bears testimony to this method of cure. He says he can "from personal experience testify to the admirable quality of the samples, which were inviting and palatable, and closely resembling English corn beef." I can add my testimony, derived from the samples furnished to us here, and the *bona fide* nature of the importation was shown by the testing of the Sanitary Committee of the Corporation, not only by inspection, but in the practical way of cooked dishes. The committee found the joints of good odour and appearance, with a fair average of fat, expressed approval of the meat, and earnestly recommended it to the poor as good food, and especially at the present time when pestilence is raging among the ill-fed. If used in workhouses it would afford a most cheap and nutritious material for soup.

In preserving meat and vegetables by the exclusion of air, they are put into tin canisters, which are then soldered, with the exception of a small hole in the lid. The

canister is then put into a saline bath, and the temperature is raised to above the boiling point, and when steam is issuing from the aperture it is dexterously sealed quite hermetically. If the process has succeeded, the ends of the canister become concave by atmospheric pressure; but if decomposition occurs, they are forced convex outwards by the gases given of. Another method by which meat is preserved perfectly sweet in the raw state is that of exhausting the air by an air-pump, and forcing nitrogen and a little sulphurous acid into the tin, as patented by Jones and Trevethick. When I acted as Food Juror in the Exhibition of 1865, several tins were opened and the meat cooked, and a slight metallic taste was the only fault which could be found. Glass or earthenware vessels could be substituted if this objection is constantly made. A case of Gamble's preserved meat, made in Cork, and left in Prince Regent's Inlet in 1824, was found in capital condition by Sir James Ross in 1849, and perhaps would have kept sweet for another quarter of a century. At one time the trade was carried on extensively in Australia, for I find that one enterprising Englishman preserved 400,000 lbs. of beef, near Sydney, in 1852. The preserving of provisions is carried on now extensively by such houses as Hogarth, M'Call (by whose process sulphite of soda is added), Fortnum & Mason, Crosse & Blackwell, and Gamble. I now present you with specimens of meat, poultry, milk, and vegetables preserved by these various processes, and I think you will acknowledge when you taste them that no sailor could starve if they were come-at-able. The principal and perhaps overwhelming objection to such processes on the large scale is their cost, and their requiring expensive machinery. Pemmican, which forms the staple diet of northern climes, is made by drying the beef in the sun, powdering it, and mixing with one-third of fat. It keeps for an indefinite period. Carniset, a somewhat similar food, has been shown to

possess great value by Prof. Parkes' experiments on some members of the hygienic class at Netley Hospital, and that gentleman has also introduced a good formula for making meat biscuits. Dr. Hassall has also given directions for the making of a flour of beef, which I have often ordered with great advantage. In South America and Australia a large quantity of extract of flesh is being made. It contains over sixty grains of organic matter, and in exhausted states of the system, such as that seen in warfare, it is truly invaluable as a restorative. It is so concentrated that it takes two or three pounds of meat to make an ounce of the extract. That prepared by Whitehead I have found very sound and nutritive. The sweetbread of calves mixed up with fat was introduced by Dr. Dobell, under the name of "pancreatic emulsion," and I have found it to possess very fattening effects.

You are doubtless aware that horse-flesh is eaten extensively on the Continent; in one fortnight alone in Vienna, in 1854, 32,000 lbs. of it were sold. In Paris the sale is legalized, and we lately heard of a great banquet given by enthusiastic hippophagists. Its resemblance to beef may be judged of from an anecdote related by Lewes. A Frenchman, remonstrating against the supercilious scorn expressed for the beef of his country by the English, whose beef he did not, for his part, find so very superior, exclaimed, "I have been two times in England, but I nevère find the bif so supérieur to ours; I find it vary convenient that they bring it to you on leetle pieces of stick for one penny, but the bif is not supérieur." You will guess at once that he had been eating cat's meat. It is generally believed that potted meats, tongues, &c., are often derived from the same source. Dr. Playfair gives the following table of the uses to which a dead horse is put—average value 40s., weight 950 lbs.:

Parts.	Weight, lbs.	Value.			Uses.
		£	s.	d.	
Hair . .	1½	0	1	3	Haircloth mattresses, plumes, seed-bags.
Hide . .	30	0	8	0	Leather.
Sinews . .	6		..		Glue and gelatin.
Flesh (boiled) .	224	1	8	0	Meat for men, dogs, and poultry.
Blood . .	60		..		Prussiate of potash and manures.
Heart and tongue	..		..		A mystery.
Intestines . .	80		..		Covering sausages.
Fat . . .	20	0	3	4	Lamps.
Bones . .	160	0	6	0	Knife handles, phosphorus, superphosphate, and bone dust.

What is known as "slink veal," or the flesh of calves born dead, or dying within a day or two of birth, is sold to the poor, and is most dangerous stuff. It is a pale, flabby, and watery meat, which the butchers blow up with their breath, but it contains only about one-fourth its weight of solids. It is extremely liable to bring on diarrhœa. Prof. Owen has strongly recommended that the eland should be reared for food supply. A few facts with respect to the methods of preparing animal food for use may, through you, reach your cooks—a confraternity, however, proverbially unteachable. Boiling lessens the weight of meat nearly one-third; and so as to retain the juice, the piece should be large, and should be plunged at once in boiling water to harden the outer crust; it may then simmer till all the meat is heated to the boiling point. The rules for making broth are just the reverse; and, indeed, Liebig's soup may be made with cold water, to each pint of which six drops of muriatic acid, some salt, and a half-pound of beef chopped fine

is added. This is most nutritive and restoring, but its red colour is often objected to. In roasting, the loss of weight is mainly water and fat, or "dripping," the juices being retained by the crust the fire soon produces on the outside.

Peas and beans abound so much in the albuminoid named legumin, or vegetable casein, that I have urged their consumption by the labouring classes in these countries, and in Germany and Scotland they have long been the poor man's comfort. How perfect a support they afford is attested in Holy Writ; in the Book of Daniel we read that the Hebrews were supported on pulse and water, "and after ten days their faces appeared fairer and fatter than all the children that eat of the king's meat." Herodotus tells us, too, that lentils formed the food of the labourers who built the Pyramids. The following analyses exhibit the composition of peas:

	Peas dried green.	Dry ripe Peas.
Starchy matter -	58·5	58·7
Nitrogenized matter -	25·4	23·8
Fatty matter - -	2·	2·1
Cellulose - -	1·9	3·5
Salts - - -	2·5	2·1
Water - - -	9·7	9·8
	100·0	100·0

Their superiority in composition and greater solubility in water when pulled green suggests that that plan should be adopted, especially as the ground is thus left in July ready for another crop, and insects cannot damage the return. The starchy matter then is sufficiently abundant, and the nitrogenized substance exists in great quantity, and is, moreover, of the most excellent quality, being legumin, which is identical with the casein of milk, and therefore of all aliments the most soluble and most natural. Their nitrogenous element is so abundant

that one pound of peas contains as much material for muscle as fifteen pounds of potatoes. Legumin with lime forms a hard, insoluble, and rather indigestible compound; and it is probably for this reason that peas boiled in hard water are not very quickly or very comfortably digested—but the addition of a little soda, or the substitution of river, or, still better, rain water, in which they should be steeped for a few hours, removes this objection. However, moderate slowness of digestion is not an objection to an aliment for a working man, as hunger then more slowly returns in the intervals of his meals. During a recent visit to the neighbourhood of Mr. Allan Pollok's vast property in the county Galway, I was informed that his labourers, especially during harvest time—the season of greatest muscular exertion—were fed upon pease porridge, and the only objection I heard offered to it was, "that it was very stuffing, and that it was a long time before appetite returned." This was a complaint which I wish our half-fed peasantry were able to make; and at any rate it could be easily removed by diminishing the proportion of peas to other food; and in the case of horses' food, the great nutritive power of peas and beans is diluted advantageously with chopped straw or chaff. The sandy, gravelly, and calcareous soil of many parts of Ireland is very fit for the growth of peas, which, moreover, require no manuring, if seeds, and not abundant straw, be required; and the more closely farmers and other employers can be induced to assimilate the food of the Irish to that of the Scotch labourer, the higher will be raised his mental and physical capacities. The identity of the principle of peas with that of milk is shown by the excellent cheese or taofoo which the Chinese make from the former. Peaflour or peameal makes a wholesome and most nutritive bread if mixed with wheaten flour, or they are very readily used as soup or brose. As an example of credulity, and the

price people pay for it, I may mention that Dr. Hassall has proved that Du Barry's Revalenta, which sells for 2*s.* 9*d.* a pound, is a mixture of Arabian lentil with barley flour, and he gives receipts by which it may be made for 2d. per pound. I lately saw a most healthy old gentleman, aged 72, who had for many years almost entirely subsisted on this mixture. In some Indian villages the mixing by mistake with peas of the lathyrus has led to even 12 per cent. of the population being paralysed by that poisonous vetch.

It has been generally regarded as wasteful to reject the bran in bread-making, for analysis and the microscope show that one-third of the gluten or sole tissue-producing ingredient exists in it. Bran contains more saline matter than the flour, including six times as much potash. Even the cellulose, although not nutritive, is useful in giving bulk and in stimulating the intestines. We are receding in the art of dietetics in regard to whole-meal bread, for up to some forty years ago it was most generally used in these countries. In France, in 1658, an ordinance of Louis XIV. was issued, which had the effect of compelling the bran to be used with the flour as human food; and in ancient times the process of bolting flour, or separating the bran, was unknown. Dr. E. Smith, F.R.S., of the Poor Law Board, in an able paper before the Society of Arts last December, after quoting my opinion and that of other physiologists on this subject, argues that the bran is merely excremental, and as such is discharged from the body, producing, by the way, purging, which may be injurious, and which can be always better excited by medicines. Dr. Smith stands alone in this opinion, which, however, has great weight from his eminent position as a physiologist. There is a vast quantity of gluten separated in starch factories which, perhaps, might be saved for food. Rye-bread, the pumper-nickle of Germany, is an economical, wholesome, and nutritious food; and that grain

might be raised in many parts of this country which, from conditions of soil and climate, are unsuited for the culture of wheat. It thrives and produces abundant returns in sandy, calcareous soil, even at high elevations, endures greater cold, ripens in a much shorter period of sunshine than wheat, and grows so rapidly that it overreaches all weeds, which are then comparatively harmless to it. It contains equal quantities of nutriment with that grain, and the bread made from it excels wheaten bread in retaining moisture and remaining fresh. Its crumbly character makes it easily digested, and it is said a smaller portion satisfies hunger and supports life than of most other breads, while a smaller proportion of the flour is required to make an equal weight of bread. The only objection which can be urged against it is the trivial one of colour. It forms the staple food of central and northern Europe, and all parts of America where Germans have settled; and it is recorded of the people of Westphalia, who live almost altogether upon it, that they are more free from dyspeptic complaints than almost any other people. Rye contains twice as much lime, and three times as much phosphoric acid as wheat. M. de Jonnes, a great French statistician, ascertained that the soil of Ireland would produce three times as much rye as that of England, and one and a-half times as much rye as wheat. There is certainly some danger from the fact that rye is pretty often attacked with ergot, or "spurred," which produces in Continental countries many cases of mortification of the feet, and even death. Alum, that common adulteration of bread, leads to dyspepsia and constipation. This reminds me that I should mention how all-important to health is the natural daily action of the bowels, for otherwise no one can be in health; their distension and irritation by the retention of decomposing food must result. Habit has much to do with their regular action, which may be aided by partaking at meals of water freely, or of brown bread, honey, or other foods known to be laxative.

LECTURE VII.

FOOD CONTINUED.—HEAT-PRODUCING FOODS.—DIETICS.

THE first heat-producing food I shall notice is the potato, which, I fear, we must still call our national food. I place it in this category, as the very minute proportion of gluten it contains (one and a-half per cent.) cannot entitle it to the higher rank. The value of any aliment may be fairly judged of by comparison of its composition and that of the blood it is destined to make, for this fluid may be regarded as purveyor-general to all the tissues. The following table puts the potato to this test, and even the small amount of nutriment it possesses is so obscured by incorporation with starch in immense quantity, and consisting of particularly large grains, that I doubt if it be all utilized in digestion :

	Blood.	Potato.
Flesh-producing matter -	20. -	1·6
Heat-producing matter -	.15 -	22·83
Saline matter -	.63 -	1·56

This bulky matter in their foods accounts equally for the distended bellies of the potato-feeder and the rice-eating Hindoo—the latter of whom, however, has been shown to add a considerable proportion of pulse, dried fish, and butter to his diet, or else he loses health. I am sure that our potato-fed countrymen would improve on an animal diet, but the Scotch writer of a recent treatise on hygiene must surely mean the following statement as a joke : "We learn that the former (the Irish) are of low stature, have pot-bellies and bow legs, whilst their open, projecting mouths, prominent teeth, exposed gums, advancing cheek-bones, and depressed

noses, bear barbarism on their very front." As an addition to other foods the potato is admirable; for instance, its mineral ingredients make it highly anti-scorbutic: its value was put in a very practical shape by the American Sanitary Commission, for they said that a barrel of potatoes annually supplied was equal to one man preserved. But when we find it used as an exclusive food, disease must be rife among its consumers, and it is responsible for much of it directly. Before the direful famine, the dense population of Ireland could scarcely drag on existence except for this crop, for by extreme subdivision of land, the peasant could not raise enough of any other on his little patch to support his family, at least by the primitive modes of culture he was acquainted with. There was no daily employment for many of them by which he could earn money to purchase better food, and I am afraid I must assign as the chief cause of his affection for the potato that it could be raised by a few weeks' exertion out of the year, leaving him at ease for the rest of it. The crop is now so precarious that our countrymen have lost faith in it, and I feel sure this circumstance, and the difficulty of obtaining any food, is one of the main causes of that lamentable emigration which is still proceeding. It is interesting to remark the altered tastes of the Irish peasant at the present day. He has a need for fluid aliment, such as tea, to make up for the water supplied before by the potato; and this beverage also happily is substituted for whisky, to which it is somewhat analogous, though far less hurtful in action. Indian meal and white wheaten bread, which I would gladly see exchanged for wholemeal bread, form the staple food of many counties; in others, dependence is almost wholly placed on the potato. I stated in my last lecture that I believed that the greatest benefits would result from adding some flesh-producing material, as peas or cheap meat, to the dietary. The potato has depressed the prosperity of other places be-

sides Ireland; for instance, a few years ago the peasantry of Somersetshire and Devonshire were living almost exclusively on this faulty food, and they were conspicuous for wretchedness in a land elsewhere of plenty. The industrial, naval, and military greatness of England very chiefly depends on the excellence of the food of her people, and Irishmen when from home excel them in physical power, as they do in mental quickness, because they are better fed. That at home the Irish agricultural labourer is deficient in endurance of toil, and is apathetic to his unwholesome condition (or, as it is perversely called, contented), it cannot be denied by any truthful or disinterested observer. In a new field of exertion, how different are his characteristics! In the most cultivated and prosperous of the States of America, the Irish labourer is remarkably industrious; but he fares right well, as will appear from the following *menu*, which is a very usual one in Pennsylvania—Breakfast at five, A.M.—tea and coffee, fried pork or mutton, pork sausages, curds sweetened, buck-wheat cakes with syrup, fried potatoes and onions, and sour kraut. Luncheon at ten, consisting of fruit pies, to which was generally added a pretty free stoup of rye whisky. The dinner at twelve, and the supper at five, were much the same as breakfast, save that there was more meat at the former, and more pies at the latter.

The Privy Council published, in 1864, the results of the investigations into the dietaries of Great Britain and Ireland, which had been made by Dr. E. Smith, late Physician to the Hospital for Consumption, now Poor Law Medical Inspector. That physiologist reports: "On the whole there was the most nutriment, the least sum spent upon food, the least variety of food, the greatest economy in the selection of food, the most breadstuffs and milk, the least sugars, fats, meats, cheese, and tea in Ireland. There was the least amount of nutriment, the greatest variety of foods, the most costly

selection of food, the least quantity of breadstuffs and milk, the greatest quantity of sugars, fats, and meats in England. The average cost per head of this food was in England 2*s*. 11$\frac{7}{8}$*d*., in Wales 3*s*. 5$\frac{1}{2}$*d*., in Scotland 3*s*. 3$\frac{3}{4}$*d*., and in Ireland, 1*s*. 9$\frac{3}{4}$*d*." As regards this country, these conclusions will excite surprise. The first is, I think, quite a misconception, and for "nutriment" I would substitute "bulk."

In November, 1863, I drew attention, at one of the evening meetings of the Royal Dublin Society, to the evils which resulted from the wretched food of our agricultural peasantry, and which as an hospital adviser were daily presented to me. I was much gratified by the practical application of the principles I advocated in the remarks of Captain Henry, a large landed proprietor, who on that occasion said: "I thought it a pitiable thing to see men, when dinner-bell rang, sitting behind a hedge, or crawling into a plantation, to eat their half-cold potatoes, or basin of stirabout, or perhaps a piece of oat-cake, brought in their pocket in the morning; and I at once determined to establish a mess, and will now give you the statistics of its working during a period of eight months. The prices charged in the sheet are the regular market price in the district, and the people can have any provisions they require for their Sunday dinner at cost price. I endeavour to vary their diet as far as possible; and you will see by the abstract that fresh and salt fish, and fresh and salt meat are provided for the mess, and the allowance served out each day is as follows, which proves amply sufficient:—Twice a-week, broth, made from $\frac{1}{2}$ lb. of beef per head, thickened with oatmeal, and with seasoning vegetables; twice ditto, fresh or salt dried fish, with melted butter; and the other days salt beef or bacon and vegetables. The consumption of potatoes each day is 3$\frac{1}{2}$ lbs., and milk 1$\frac{1}{2}$ pints per head, the surplus waste of potatoes and other vegetables turning in for farm use. There was

some little difficulty at starting, but all was soon got over. Knives, forks, and plates have taken the places of fingers and tin cans; and the people enjoy a hot and comfortable meal, which, under other circumstances, would be utterly beyond their power or means. I would wish to point out some advantages which result from this system. The wife or child, who formerly lost the day in preparing and bringing the mid-day meal, is now employed at a profit. If a wife have small children, she can now remain at home, and have the necessaries of life at cost price, instead of getting into the hands of those small dealers who are the pests of every country village; and any of the labourers' children, whether able to work or not, can have their dinner at the mess. The labourers have improved in condition and appearance, and are, I am satisfied, able to do a better day's work." The balance sheet of the transactions, given on the opposite page, is most satisfactory.

The effects of an improved dietary in increasing the labouring power of man is often strikingly shown along our quays and docks; for the Greek sailors, living previously on fruit, maccaroni, and oil, are able to purchase animal food when they come to port, and their strength and endurance becomes in a short time amazingly augmented. Fatty food has always afforded the best example of a diet being necessarily altered with temperature, for in cold latitudes it is greedily consumed, as related by so many northern voyagers. Some of the Russian tribes are especially voracious, for we are informed one of the Yakuti ate in the twenty-four hours the hind-quarter of an ox, and twenty pounds of fat, which he moistened with melted butter, a beverage to him luxurious; and a calf weighing 200 lbs. is considered a fairly apportioned meal for five. Sir John Franklin tried how much fat an Esquimaux boy could consume—14 lbs. of tallow candles quickly disappeared; and Sir John closed the experiment with a piece of fat pork, as he began to feel apprehensive for his stores.

Dr. THE MESS.

The Mess is here charged with the total quantities of provisions supplied from 4th April to 14th November, 1863.

Article.	Quantity and Price.	Total.
	tons. cwts. qrs. lbs.	£ s. d.
Oatmeal..	0 1 2 23 @ 14s ℔ cwt. ..	1 4 0
Potatoes..	5 11 1 28 @ 2/7 ℔ cwt. ..	17 15 11
Meat.....	0 7 2 19 @ 3⅝d. ℔ lb ..	12 17 10
Bacon ..	0 4 0 27 @ 3¾d. ℔ lbnearly	6 19 10
Dried fish	0 4 1 8 @ 12/6 ℔ cwt. ..	2 15 2
Eels	0 2 2 14 @ 2d. ℔ lb ..	2 9 0
Onions..	0 0 2 23 @ 1½d. ℔ lb ..	0 9 10
Barley ..	0 1 1 13 @ 1½d. ℔ lb ..	0 18 10
Butter ..	0 0 0 10 @ 10d. ℔ lb ..	0 8 4
Flour....	0 1 1 12 @ 14/ ℔ cwt. ..	0 19 0
Milk....	.. ..	3 8 6
Turnips...	.. ..	0 0 6
Cabbage..	.. ..	1 2 4
Bread....	0 2 3 1 @ 1½d. ℔ lb ..	2 12 0
		54 1 10

Cr. CONTRA.

This side shows the number of persons fed, and the amount of their contributions each fortnight to the Mess Fund, by deductions from their wages at the rate of Threepence per day for men—Twopence per day for women.

Date.	Men. Dinners each fortnight.	Women Dinners each fortnight.	Total. £ s. d.
April 4	116		1 9 0
„ 18	122	36	1 16 7
May 2	112	36	1 14 2
„ 16	97	36	1 9 11
„ 30	77	36	1 6 6
June 13	22	18	0 8 8
„ 27	175	100	3 0 4
July 11	199	149	3 14 7
„ 25	217	152	3 19 10
August 8	217	123	3 14 9
„ 22	222	164	4 1 1
Sept. 5	194	107	3 6 7
„ 19	282	136	4 13 2
October 3	242	100	3 18 11
„ 17	261	127	4 6 5
„ 31	240	127	4 1 0
Nov. 14	232	110	3 16 4
	3,034	1,556	
Total collective number of dinners, 4,590			50 17 10
Value of the stock in hands			3 4 0
		Total ..	54 1 10

Average number of persons dining for the entire period, 22¼.

Oil is a luxury greedily devoured by the northern races, as was amusingly proven in a seaport town some years ago. The town was lighted by oil-lamps, and the inhabitants remarked that they went out for several successive nights; at last it was discovered that some Russian sailors in the harbour climbed the lamp-posts and drank the oil.

All fats which are used by man consist of either olein, margarin, or stearin, which are usually combined in various proportions. Castor oil, for instance, is almost pure olein. There is much margarin in most animal fat (that of the wild American horse contains it most plentifully); and palm oil, from which candles are made, has a very large proportion of stearin. All these kinds of fat are composed of a base which is well known as glycerin, and an acid which is named oleic, margaric, or stearic, according to each variety. Fat cannot be utilized in the system by being absorbed into the blood until it has been acted on by the bile, or the juice of the pancreas, which have been shown to emulsify or minutely divide it. Animal foods, and many vegetal ones, supply us with fat; nuts of various kinds contain it, and especially filberts (so called from the "full beard" which envelops the nut-shell).

Starchy foods, such as arrow-root, rice, a large proportion of the potato and of cereal grains, must be converted into grape sugar before they can be taken into the blood, and as this change takes place in the mouth by the action of saliva, they require even more admixture with it by mastication than is generally accorded to them—more, I would say, than even animal food. The appearances of the starch granules in each of these foods under the microscope is so strikingly different that they may be recognized, and thus adulterations are easily detected. That sugar is still further converted into fat is apparent from one fact, the negroes of the West Indian plantations become enormously fat during

the sugar season, when they partake most freely of that food. The brilliant white teeth of this race disproves the notion that sugar injures these organs, which may, by the way, be steeped for days in solutions of sugar without corrosion. Among some African countries, the females, before they enter the connubial state, are fattened by sweet foods. Sugar is not injurious to children, as indeed is shown by their instinctive desire for it; but as it easily changes into lactic acid or fat, the dyspeptic, the rheumatic, or the corpulent must be warned of it.

Having spoken, though very cursorily, of the two great groups of food—the flesh-producing and heat-producing, the first principle of dietics I have to inculcate is that they shall be mixed in due proportion, and should be supplied with considerable variety, as the complexity of human tissues plainly demands. This necessity was first demonstrated by Majendie, for he found that such simple substances as sugar, gum, fat, gelatin, and even pure flesh-substance would not support dogs, for they died nearly as soon as if wholly starved. Most of you have heard of Dr. Stark, who, for the purpose of supporting some preconceived notion, abstained for four months from all nitrogenous food. He was attacked with uncontrollable diarrhœa, became fearfully emaciated, and died a victim to his misdirected zeal for science. It is popularly believed that jellies are highly nutritive, and cooks swear by soups, which thicken because of the presence of this material; but there is no greater fallacy—it is doubtful if it feeds us at all. Previous to the sitting of the Gelatin Commission they proposed to feed the poor by the soup obtained by boiling bones, but it was shown to be nearly valueless. One enthusiastic investigator who subsisted on *twenty-five quarts of bone* broth daily, had to give up at the end of four days. If it acts as food at all it must be as a diluent of other matters, and the same may be said of

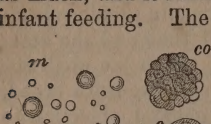
cellulose, in which many vegetal foods abound. The admirable adjustment of all nutrient matters in due proportion in milk and the egg presented to us by Nature, and in bread—a food so universal that it may be said to be naturalized to all mankind—teach us useful lessons in dietics. It may be instructive to study one or two of these natural foods more fully.

Bread consists (1) of starch, which may be readily removed by washing the flour with water; it, as we have seen, instantaneously changes to grape-sugar in the mouth, and becomes a valuable heat-giving food. (2) Of gluten, the stringy substance which is left on the removal of the starch. It putrefies like meat, and this fact led Beccaria to suggest its identity with other tissue-feeding principles. (3) Salts, such as the phosphates and common salt, the importance of which as elements of diet I have before talked of; and (4) water. By the way, the amount of water does not constitute the difference between fresh and stale bread, as has been often supposed, for if the latter be placed in an oven, much water must be expelled, but its "freshness" is restored. The only feeding group not represented in the "staff of life" is the fatty—but a time-honoured custom has supplied this deficiency with butter. Bread is of two principal kinds—unvesiculated, in the form of biscuit, or the unleavened bread; and vesiculated, or spongy, which excels by exposing a greater surface for the action of the saliva. The yeast which is employed in making the dough excites fermentation, by which some of the starch is converted into carbonic acid—a gas which makes the mass light and spongy—and into alcohol. The quantity of alcohol given off is inconsiderable, yet a bread-making company was started in London which proposed to economise by collecting it. The upholders of the old system rendered this bread very unpopular by the announcement in their shop windows of "bread sold here with the gin in it." Ærated bread is made

by mixing the flour with water charged with carbonic acid, and a saving of starch, which during fermentation is lost, was said to accrue. The application of improved machinery to bread-making would ensure greater cleanliness, and would promote saving of time and the amelioration of the bakers' condition, which we shall see hereafter is sorely needed. With regard to fresh bread, Dr. E. Smith says: "There is a general objection to the use of new bread, either on the ground of economy or health. As to economy, it cannot be doubted that persons, and particularly children, eat more freely of new than of stale bread, and that its flavour is more tempting to the appetite; and if the quantity which is thus eaten is in excess of the requirements of the body, it can neither be healthful nor economical. The objection on the score of health may, however, be more safely based upon the less digestibility of new than of stale bread, owing, I think, to its greater tenacity leading to less perfect mastication. The indigestibility is not so much due to any chemical quality, as it may be attributed to its physical condition." The same writer compares meat and bread as follows: "The quantity of nutriment which can be obtained for 1*d.* in meat varies in carbon from 295 grains in beef to 1,070 grains in American bacon, and in nitrogen, from 70 grains in liver to 17 grains in beef, and 20 grains in American bacon; whilst wheaten flour offers 1,773 grains of carbon and 83 grains of nitrogen. We see how small should be the proportion of the former to the latter in the dieting of one to whom economy is of the first consequence."

The subject of milk is still more important, as it concerns the question now attracting so much attention—namely, infant mortality. The more important components of milk are four: 1. Casein, the flesh-producing element. Of this there is one-third more in cow's milk than in human milk, so that the former to be a substitute for the latter needs dilution. 2. Butter, the main

heat-producing material, exists in about equal amount in these two fluids; but in asses' milk there is but half as much, and it should be enriched by cream if used for infant feeding. The little globules which constitute the cream are here figured, the large ones being those of the milk of the first day. The milk drawn in the morning is one-fourth less valuable than that of the evening, because of the longer interval of feeding. 3. Sugar; this heat-producing agent greatly preponderates in asses' milk, and thus in part compensates for its deficiency in butter. It is interesting to remark that the sugar of milk is not readily fermentible, for if it were, the gases evolved thereby would injuriously distend the infant's bowels. The Arabs, however, make from mare's milk an alcoholic liquor they call kumiss. The sugar soon changes into lactic acid, and then milk becomes sour and thick from the throwing down of the casein. Any decomposing milk will turn a large quantity at once, and hence the need for extreme cleanliness of all vessels used to collect it. 4. Mineral substances, which are twice as plentiful in cow's milk as in the infant's natural food—a fact which also shows the need for dilution. The practical rules we derive from these comparisons are, that cow's milk should be diluted, and then cream and sugar added to make up for the addition of water. The following are the best proportions—cow's milk, eight ounces; cream, two ounces; water, six ounces; sugar of milk, half-an-ounce. The addition of some nutritive flour, as corn-flour, improves such food for infants, and prevents the milk from souring so rapidly as it often does; but all such artificial mixtures are but poor substitutes for that which Nature designed, and when one reflects on the conditions milk may be subjected to, by being kept too long, by adulteration, by the animals which



Globules of Milk.

yield it being unnaturally cooped up in cities, and the difficulties of adjusting its temperature and dilution, mortality among infants, enormous though it be, cannot excite surprise, though it appeals for remedy, I trust not in vain. So susceptible are infants of any noxious influence that impurities of food, to even a much less extent than those I have mentioned, are capable of producing digestive ailments, which, along with the nervous diseases they excite, slay one-fifth of the children that are born. I may mention that in our city such causes seem to be rife, for during the year nearly 500 deaths, or one-fourteenth of the entire, occurred from infantile convulsions, in the production of which good breast-nursing is, of all unsanitary conditions, the most powerful. Every effort should be made to remove those impediments to breast-nursing which physical conditions produce, or social causes seem to justify. It is undoubted that the quality of mother's milk is greatly influenced by the temper, and instances are given of the poisonous effects of milk secreted during fits of passion; and if the following opinion of Moleschott be worthy of credence, the suckling of infants is indeed a matter of import: "It is no empty prejudice to state—nay, it is a real belief in the general prevalence of a demonstrated natural law, that the nature of the mother is communicated by the milk to the child. And there is no thought more natural than the belief, that on the breast of its mother the infant may imbibe, together with the milk, her nobleness of mind, with the love which devotes that food to the most sacred purpose, and fastens still more strongly around the feeble child and the tender mother the ties of their endeared relationship."

The composition of milk is by no means uniform during all periods of suckling, but is most admirably fitted to the requirements of the bodily functions at each period: thus, for the earlier months, when independent

heat is so greatly needed, the fat and sugar preponderate; while in the later months casein increases to feed the growing nervous and muscular tissues. Milk, then, is truly a typical food, supporting the infant for several months in perfect health; even the sourness which it easily undergoes is highly antiscorbutic. In children we may learn the appropriate changes of diet according as the various kinds of teeth come out—the canines indicating the fitness of solid animal food. During youth it should never be forgotten that food is required for growth as well as repair, and that if it be insufficiently supplied, the growth may proceed at the expense of the proper daily nutrition of the body, as is every day exemplified by the rapid consumption observed in those who are "outgrowing their strength." During the later months of lactation starchy foods may be added, but any excess of them is carried off by the bowels, and must do harm. The waste of tissue and growth are so active in infancy that the amount of food required is four times proportionally greater than in adult life. Old age, being in regard to tissue-waste the antithesis of infancy, its requirements as to the supply of food are just the reverse. This is remarked by Cicero while acknowledging another peculiarity of advanced life: *Habeo senectuti magnam gratiam, quæ mihi sermonis aviditatem auxit, potionis et cibi sustulit*; and old Cornaro fared daily on twelve ounces of food and two-thirds of a pint of light wine.

The same principle which influences the amount of food proper for each of those epochs teaches us that the supply should be proportional to the expenditure, for the constant labourer, whether bodily or mental, has generally an ample appetite, and yet has rarely to complain of corpulence or the deposit of unused food; but, on the contrary, persons under the influence of strong passions lose, *pro tempore*, desire for food, and it has been even said that the weakness of such emotions in old age accounts for the improved appetite often ob-

servable. That idiosyncrasies or individual peculiarities exist with regard to food is well known, and need not surprise us when we find that many animals obtain nutriment from plants which to others are deadly poison.

This may be said even of animals of the same species; for instance, the black rhinoceros greedily eats the *Euphorbia candelabrum*—a plant which rapidly destroys the white variety. Many substances which, if introduced directly into the circulation, would prove deadly, are innocuous if taken into the stomach, for in passing through the coats of this organ they are decomposed, as can be demonstrated by the following experiment:—Prussic acid, the most virulent of poisons, can be generated by a mixture of emulsin and amygdalin, two of the substances obtainable from almonds. Now, if the emulsin be swallowed by a dog, and amygdalin thrown into his veins, the poison is not formed; but if the position of these two substances be reversed, prussic acid results, and death instantaneously occurs. The most remarkable example of complete aversion to animal food is that of the Abbé de Villedieu, who could not be persuaded to touch any till he had attained the age of 30, when, we are informed on reliable authority, he died from the effects of a meal of such food forced upon him.

The principal dietic question is after all the quantity of food, and I may at once say that, as regards England, I agree with the sagacious Cobbett, that for every one man who dies of starvation, seven die from over-feeding. Our complaints on this side of the Channel are in the opposite direction. For an ordinary man, say 140 pounds in weight, and 5 feet 8 inches in height, the quantity of food, solid and fluid, should average daily 110 ounces, of which 70 at least should be water, bearing in mind that over 100 of his 140 pounds weight consist of that fluid. The average of the female body

is 121 pounds. The annual quantity of food then required averages about 2,500 pounds. So much of our apparently solid food is really combined water, that of the 40 ounces, but 18 or 20 ounces of anhydrous new materials is thus daily supplied us, and the groups of food which I have spoken of should be apportioned in this amount as follows: 12 ounces starchy matter, $2\frac{1}{2}$ of fat, 4 of albuminoid, and 1 saline or mineral matter. Dr. Hammond, late Surgeon-General United States army, states that in 24 hours he was able to absorb $27\frac{1}{2}$ ounces of albumen. The composition of some usual aliments is exhibited in the following:

TABLE OF THE NUTRITIVE VALUE OF FOOD PER CENT.

	Nitrogenized.	Starchy.	Fat.	Salts.	Water.
Arrow-root ..	..	82	..	..	18
Potatoes ..	2	23	0·2	0·7	74
Cow's milk ..	4·5	5	4·1	0·7	86
Rice ..	7	76	0·3	0·3	14
India meal ..	9	65	8	1·7	14
Wheat flour ..	11	70	2	1·7	15
Oatmeal ..	12	62	6	3	15
Eggs ..	14	..	10·5	1·5	74
Beef ..	19	..	5	2	73
Peas ..	22	58	2	8	13
Beans ..	24	44	1·4	3·6	14
Lentils ..	29	44	1·5	2·3	14

As an example of the quantities of food and their mixed characters, which should be apportioned to men under different circumstances, I quote for you the daily quantities in the low, half, and entire diets of the military hospitals:

Low.		Half.		Entire.	
	oz.		oz.		oz.
Meat ..	8	Meat ..	8	Meat ..	12
Bread ..	14	Bread ..	16	Bread ..	16
Salt ..	$\frac{1}{2}$	Potatoes ..	8	Potatoes ..	16
Tea ..	$\frac{1}{4}$	Barley ..	$1\frac{1}{2}$	Barley ..	$1\frac{1}{2}$
Sugar ..	$1\frac{1}{2}$	Salt ..	$\frac{3}{4}$	Salt ..	$\frac{3}{4}$
Milk ..	6	Tea ..	$\frac{1}{4}$	Tea ..	$\frac{1}{4}$
Butter ..	1	Sugar ..	$1\frac{1}{2}$	Sugar ..	$1\frac{1}{2}$
Rice ..	2 } Pudding.	Milk ..	6	Milk ..	6
Sugar ..	$\frac{1}{2}$ }	Vegetables	4	Vegetables ..	4
Egg ..	1 }	Butter ..	1	Butter ..	1
Milk	(pint) $\frac{1}{4}$ }	Flour ..	$\frac{1}{4}$	Flour ..	$\frac{1}{4}$

The diet of the British soldier in India consists of meat, 1 lb.; bread, 1 lb.; vegetables, 1 lb.; rice, 4 ozs.; sugar, $2\frac{1}{2}$ ozs.; tea or coffee, $1\frac{3}{4}$ ozs.; salt, 1 oz., with 3 lbs. of firewood daily to cook it. In the time of Edward VI., Froude tells us that the soldier's diet consisted of 2 lbs. of meat, 1 lb. of bread, and a pint of light wine.

Mr. Chadwick mentions a remarkable instance of the combined effects of prison dietaries with improved sanitary conditions. Among soldiers in barrack the death-rate is seventeen in a thousand. Some of the worst-conditioned were put into military prisons in Ireland, and the death-rate declined to two and a-half, and sickness in proportion. They had no meat, tea, beer, tobacco, or their usual stimulants, and were fed on half-a-pound each of oatmeal, Indian meal, and wheaten bread per day, with half a-pint of milk, and their general health and strength greatly improved. The difference of condition was very extraordinary when we compare the dietary in the Irish military prison with the barrack ration, which consists of three-quarters of a pound of beef or mutton without bones, one pound of

bread, same of potatoes, with tea and coffee for breakfast and supper. On the other hand, Mr. Frank Buckland, ex-surgeon of the Guards, found that Irish recruits, apparently strong and muscular, after being put on regimental rations, broke down in going through their duties. He thought the potatoe had done the mischief.

Dr. E. Smith investigated the dietaries of the working classes for the Government in 1864, and in his report he gives several examples of weekly dietaries, their chemical value, and their cost. I quote the cheapest and the dearest of those he proposes for each person weekly:

Bread, 9 lbs.; oatmeal, 1 lb.; meat, ½ lb.; bacon, ¼ lb.; skimmed milk, 3½ pints; butter-milk, 3 pints; and vegetables, 4 lbs. This would give milk-porridge twice a day, with bread and vegetables daily, and meat five times a week. Carbon, 4,004 grains, nitrogen, 201 grains daily; cost, 1*s.* 11¾*d.* weekly.

Bread, 8 lbs.; oatmeal, 2 lbs.; peas, 1 pint; sugar, ¼ lb.; treacle, ½ lb.; butter, 2 ozs.; 4 herrings; bacon, ¼ lb.; liver, ½ lb.; skimmed milk, 6 pints; coffee, 1 oz., and vegetables, 2 lbs. This is an excessive dietary, and particularly in nitrogen. It supplies animal food six or seven days, in the form of liver and bacon, with boiled pease-pudding, or herring, and vegetables, oatmeal pudding with treacle, milk-porridge, coffee, bread and butter, and treacle. Carbon, 4,714 grains; nitrogen, 265 grains daily; cost, 2*s.* 6*d.* weekly.

On presenting the report the medical officer of the Privy Council said: "The inquiry was (like all their lordships' inquiries) essentially for the purposes of England. But, even for these purposes, some exterior standards of comparison were wanted. And accordingly, just so far as was necessary for that end, information was sought also in Scotland and in Ireland. The number of households visited was, in England and Wales 554, in Scotland 29, in Ireland 52. In 125 cases (all English) the inquiry related to the poorer classes of in-

door workpeople—silk-weavers, needlewomen, glove-stitchers, stocking-weavers, shoemakers, &c., who, almost entirely were town residents. In nearly all the remaining 509 cases, the inquiry related to farm-labourers. This statement of numbers will sufficiently show that the inquiry did not pretend to be exhaustive."

Dr. E. Smith's previous theoretical estimate of the minimum quantity of food on which life could reasonably be expected to subsist, formed the scientific basis for the advice which was given to the cotton towns on the subject of their allowances for the poor. In order to avert starvation-diseases, a woman's daily food ought to contain at least 3,900 grains of carbon, and 180 grains of nitrogen; and a man's at least 4,300 grains of carbon, with 200 grains of nitrogen—or for the woman about the same quantity of the nutritive elements as two pounds of good wheaten bread contains, and for the man one-ninth more. During 1863, Dr. Smith's inquiries convinced him of the greater nutriment which the Irish labourer by milk, and the Scotch labourer by diseased mutton, obtained over that of the Englishman, as shown in the following table of the carbon and nitrogen weekly consumed by an average agricultural adult:

	Carbon. Grains.	Nitrogen. Grains.
England ...	40,673 ...	1,594
Wales ...	48,354 ...	2,031
Scotland ...	48,980 ...	2,348
Ireland ...	43,366 ...	2,434

I have not made inquiries with the same object, or with any degree of chemical accuracy, but I have been intimately acquainted with the habits and dietaries of the Irish in every district, and there is a stong impression on my mind that Dr. Smith over-estimates the amount of milk used when he brings out the conclusion that the Irish labourer gets more nourishment than the

Scotch or the English. Dr. Smith's economical deductions are so valuable that I shall quote them to you verbatim: "All attempts to improve the exterior social condition of the people, as seen in their houses and dress, must be accompanied by an increase of their income, since any sum abstracted from their present income would lessen the amount of food obtainable, and thereby induce disease. The leading idea to be borne in mind is, that the present condition of the Irish labourer is a mere struggle to preserve health and strength. More constant labour, even at the present low rate of remuneration, would be a great gain; but the introduction of other occupations than that of farming would improve the condition of this class, by increasing the rate of wages and the general wealth of the people. The rate of wages in the west is very low in relation to the value of the land, and many landlords seek to keep them low rather than to raise them. The increase of the cottage-garden system, whereby the labourer may profitably occupy his spare time in the production of a larger quantity of potatoes or other foods would be of material benefit."

I think the most important thing to attend to is variety of diet, and in hospitals I have seen the best effects from the careful administration of food on this principle. Some of the London hospital dietaries are very faulty—in one no butter is allowed, in another no potatoes; but in St. George's, according to the description of my friend, Mr. Charles Hawkins, the patients fare right well: "Tea, with a teapot to make it; great variety of food, from a mutton chop to an ice from Gunter's; better cooked meat than he could get at his own club." Whether owing to this or other circumstances the mortality had been steadily decreasing, having been for the last three decenniums respectively 11, 8·6, and 8·2 per cent.

Less food is required in summer, both on account of

the temperature about us then requiring less internally produced heat, and as less exercise is taken the tissue material need not be so abundant. These facts account for diarrhœa being frequent in summer, as, habit being still our guide, too much food is eaten, and the bowels discharge the surplus. There is no daily act in which greater variety occurs than in the hours at which meals are partaken; for instance, every hour between noon and eight at night is the habitual dinner-hour of various ranks, regulated sometimes by other engagements, sometimes by mere fancy. Although I allow that much variety is imperatively demanded by circumstances, I feel sure that any dinner-hour later than six o'clock is contrary to all principles of healthy digestion. I have an opinion upon the order in which foods should be taken at this meal, and I will mention it, though some will call it a crotchet. It is that soup should never be taken at the beginning of dinner. I think by its being rapidly absorbed it removes appetite, prevents the flow of gastric juice, and interferes with the pressure of the stomach upon solid food. At proper times, however, no food is more nutritious or rapidly digestible than well-made meat soup—in fact, Napoleon used to say it "made" the soldier.

With respect to breakfast, I think it should be made, in the case of delicate persons, at once after rising, and by all at no much greater interval, as it should be remembered the system has been for twelve hours or more without food, and any prolonged exercise under such circumstances must be exhausting. Breakfast is notoriously a wholesome meal, and its amount indicates in most cases the degree of health which the individual enjoys. It accelerates the pulse most remarkably, whereas a late evening meal has in most cases no such effect—a circumstance which informs us that food is then less easily digested.

The alimentary value of various articles of diet is too

extensive a subject to be even broached here, and, indeed, it is one on which we possess very little positive information, if we except that which Dr. Beaumont obtained by his experiments on the person of Alexis St. Martin, who had an opening in his stomach produced by a gun-shot wound. The tables of the digestibility of various foods, which he prepared as the result of these trials, have been quoted into every popular manual, so that I do not think it is necessary to reproduce them here. The extremes may be mentioned—rice, tripe, and whipped eggs disappeared in about an hour, while four and a-half hours were required to digest salt pork. The case of Catherine Kutt, who had an opening in the bowel leading from the stomach, was even more instructive, as the effects of that organ on various food could be readily ascertained. The relative solubility of various aliments is a field of inquiry recently laid open to us by means of the new analytical process contrived by Graham, and by him termed dialysis; and some investigations of my own conducted in this manner, which many other engagements have deferred, I hope shortly to publish.

In Glasgow and London working-men's dining-rooms have been most successfully established, and have influenced most beneficially the health of the humbler inhabitants. Two such cooking depots have been established in Dublin—one in Kevin-street and the other on the North Wall. From frequent visits I can testify to the excellent quality and extreme cheapness of the viands supplied in both, and they demand and deserve support. They are conducted on the strictest business principles, with the full intention of making them self-supporting, so that all who frequent them may do so with a feeling of perfect independence. The dinner consists of a bowl of soup, plate of hot or cold meat, potatoes, and plum or rice pudding, for which the charge is $4\frac{1}{2}d$. So low a sum is remunerative, as the articles, although of excellent quality, are obtained economically and in large

quantity. Besides the diners who are served, I think that the wives and daughters of the working men ought to be instructed there in some of the principles of cooking, which are more neglected among them than among the corresponding class in almost any other civilized country. Economical purchase and advantageous management also allow the benevolent to distribute food during periods of distress at a moderate cost—for example, the following is a nutritious soup supplied at Mrs. Gladstone's soup-kitchen in Blackburn: Pea-soup for 100 rations (carbon 1,048 grains, nitrogen 75 grains; cost 0·94*d.* per ration). Beef, meat only 4½ lb.; bones, ⅔ lb.; ham, 5 lb.; salted pig's cheek, 4⅛ lb.; white peas, 20 lb.; pea-meal, 2 lb.; swede turnips, 6⅔ lb.; onions, ½ lb.; seasoning with pepper, curry, and salt.

Much good may be also done by circulating handbills among the poor, containing information about the most profitable kinds of food, and the best way of preparing it. Dr. Smith gives such handbills, but I have only space to quote one of his items:

"THE CHEAPEST AND BEST KINDS OF FOOD.

"I. *Bread and Flour.*—Select households or seconds bread or flour. Do not eat bread when it is new, but keep baker's bread one day, and home-made bread three days, before it is eaten. Do not keep it too dry, but cover it up in an earthenware pan. When it has become dry, make it into puddings, or add it to broth. Bake at home if you have an oven and firing. A labourer should eat daily nearly 2 lb., the wife and growing boys above ten years of age, 1¼ lb. to 1½ lb., and every child as much as it desires. Eat it slowly. If you are very poor, spend nearly all your money on bread."

I have not time to tell you of the influence of food upon the prosperity, physical energies, or mental capacities of communities, nor the degeneracy which an impoverished national dietary will produce, not only in

those who are subjected to it, but in their descendants. Its connexion with crime is conclusively shown by the fact, that in years when food is scarce there is always an increase of the number of committals.

Malthus believed the food of a country increased in an arithmetical proportion—that is to say, increased as 1, 2, 3, 4, 5; while the population of a country would, if unchecked, increase in a geometrical proportion, as 1, 2, 4, 8, 16. "Therefore," said he, "if the natural increase of population were not somehow checked, the time would inevitably come when the people must starve. Nature, however, in his opinion, provided such checks; namely, pestilence and epidemics, as well as the disease which is constantly carrying off the population of our over-crowded towns. War is also another check. For these checks there is one satisfactory substitute to be found, and only one—that is celibacy, and other forms of moral restraint. Unless we diminish the births, is is of very little use, he argued, trying to diminish the deaths." He then referred to the effects of vaccination. "I have not the slightest doubt, that if the introduction of the cow-pox should extirpate the small-pox, and yet the number of marriages continue the same, we shall find a very perceptible difference in the increased mortality of some other diseases." Again, "The operation of the preventive check—war—the silent, though certain destruction of life in large towns and manufactories, the close habitations and insufficient food of many of the poor, prevent population from outrunning the means of subsistence, and, to use an expression which certainly may at first appear strange, supersede the necessity of great and ravaging epidemics to destroy what is redundant."

If such reasoning were just, sanitary efforts were quite useless. But it is contrary to what we observe in every thriving population, where the means of living, wealth, and health, owing to sanitary reform, are increasing step

by step with the increase of the people. He erroneously applied the same principle to man which Darwin has applied to inferior creatures, forgetting how great a controlling influence is afforded by the mighty intellect of man.

The effects of food upon the passions and feelings is also a tempting subject for the popular lecturer on physiology and the poet, for old Prior has it—

> "Observe the various operations
> Of food and drink in several nations.
> Was ever Tartar fierce and cruel
> Upon the strength of water gruel?
> But who shall stand his rage and force,
> If first he rides, then eats his horse.
> Salads, and eggs, and lighter fare,
> Turn the Italian spark's guitar.
> And if I take Dan Congreve right,
> Pudding and beef make Britons fight."

LECTURE VIII.

FOOD CONTINUED—VEGETARIANISM—ALCOHOL—ADULTERATION—DISEASES DUE TO SCANTY OR IMPROPER FOOD.

VEGETARIANISM has so many respectable supporters who perseveringly advocate its principles, that it is necessary to inquire if they rest on a scientific basis. Animals are either herbivorous, carnivorous, or amphivorous—that is, fed by both the vegetal and animal kingdoms, which certainly contain the same elements of food, but in different proportions and under widely various forms. An herbivorous animal—the sheep, for instance—has large, flat, and rough teeth, to bruise the grass it crops with the incisors; a quadruple stomach, from which the food is again returned to the mouth as the creature "chews its cud;" and a digestive canal twenty-eight times longer than its body, such a complicated apparatus being required to convert the grass into the very dissimilar matter of its own body—in fact, into mutton. The tiger, on the contrary, has sharp teeth only, to tear flesh, a single stomach, and a short intestine, the food it devours being so similar in composition to the components of its own body. Man has incisor teeth to cut the food, canines to tear it, and molars to bruise it, for the infinite variety of the matters he consumes needs all these operations. If it be objected that no other animal is really amphivorous, and that man's teeth differ from those of all other animals, another peculiarity can be appealed to—namely, that there is no break in their position for the round of the whole jaw. His stomach is single, and the digestive canal medium, being some five times the length of his body. I will now show you by these anatomical preparations the peculiarities of each,

and you see here represented the various kinds of human teeth. The dates of the appearance of each kind is

The Human Teeth.

very regular—so much so, that the age of children before admission to factories can be thereby calculated. These physiological facts, and the experiments I have alluded to, prove the necessity of a mixed diet, and the only anatomical resemblance which, since the days of Rousseau and Shelley, vegetarians have fairly relied on is, that the female of bimana and of some herbivora have each two breasts. The adoption of a purely vegetable diet would tend to lower the physical power of man and the prosperity of nations, as we may judge by reflecting on the instances of those compulsory vegetarians, the ill-fed labourers of our own land, and the worse fed Hindoos. There are, on the other hand, parts of the world where edible vegetables are not to be had ; and at a recent public meeting at the Rotundo, the advocates of this folly had to acknowledge that they would avoid the Arctic regions, which produce no food for them. Dr. Hayes, the Arctic voyager, says : "Feed the locomotive on willow twigs, and on a frosty morning it will be very likely to cease its operations ; feed the Esquimaux hunter on wheat bread or maccaroni, and he will quickly freeze to death."

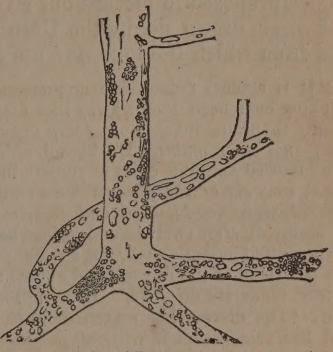
But vegetarians, so called, by no means restrict themselves to a vegetable diet; on the contrary, if the eggs and milk they consume be calculated—not to speak of the microscopic creatures they must swallow in water and

food—they take their full share of animal diet, and suppress as much or more animal life as the beef-eater, the direct infliction of pain being indeed avoided. It is this last reflection which has enlisted many of the tender-hearted in the ranks of those who abhor flesh. I wonder it has been never inferred that this quality of the vegetarians has been due to their food, for in this way there is no doubt that the temper and habits of animals can be affected—to wit, the wild and the domestic cat.

Alcohol in some form enters into the diet of nearly every nation, such various substances as rice, cocoa-nut honey, milk, aloe, juniper-berries, grapes, and cereal grains, being used to form respectively the *arrack*, *toddy*, *mead*, *koumiss*, *agua ardiente*, *gin*, *wine*, *whiskey*, and *beer*, while all contain the same intoxicating agent. Consisting principally of carbon and hydrogen, it seems capable of acting as heat-giving food, and these elements of it are rapidly oxidized out of the body. Those who use alcohol habitually take less heat-giving food, and it undoubtedly saves the muscular and fatty tissues, so that weight is really gained. The amount of carbonic acid evolved indicates the waste of our body, and it is lessened by the taking of alcohol, and as every traveller knows hunger returns less rapidly; but no one can assert that with a sufficiency of food it is at all necessary, and on the whole abstainers enjoy the better health. The fact, however, argues for a high rate of diet in those from whom we wish to keep alcohol.

It quickens the circulation, and thus diffuses warmth through the body and stimulates the brain; so that every practical physician will convince you of its use in the treatment of disease. Such are the chief arguments for alcohol put forward mainly by Baron Liebig. Now hear the other side. Those who object to its use under any circumstances assert—1st, that it precipitates the soluble part of our food; but when freely diluted it can scarcely act thus on the peptone, or nutritive material which is

made from the meat we consume; 2nd, that as a heat-giving agent it is inferior to fat, and indeed the testimonies of Arctic voyagers, and of some recent experimenters, is against the warming power of alcohol; and 3rd, that if it stimulates, depression to an equal extent must follow as a reaction, so that nothing is gained; but so far as regards the treatment of a passing illness there is no force in this objection.



Arteries of Brain injured by Fat.

No one can deny that in large doses it acts as a poison—an ounce of pure alcohol will kill a middle-sized dog; in habitual small quantites it injures the nervous system, leads to fatty degeneration of the tissues—and, as an instance, I show you the diseased condition which the arteries of the brain undergo from this cause. It also produces a fermentible condition of the blood which is more favorable to the catching of contagious diseases, and a fatal result from them. When speaking of cholera, I will give you some evidence of this. As an instance of fever, however, arising with temperance strictly preserved, I may mention that a fearful epidemic is now raging in Scorton, Lancashire, a village in which there is no dram-shop. If teetotallers neglect other sanitary reforms, they must be regarded as mere riders of a hobby.

The alcohol of drinks which contain it, is absorbed directly from the stomach, conveyed to the liver, both of which it often renders diseased—and there are no better known anatomical preparations than the drunkard's stomach and the drunkard's liver—and acts especially

on the brain, in which it produces its intoxicating effects by delaying the due receipt of blood. A fluid containing enough alcohol to be inflammable has been distilled from the brains of those who have died after drinking to excess. Teetotallers ride their hobby to the death, as may be gleaned from the following proceedings at the North Union Board during the late cholera epidemic. It was proposed to placard our city with a poster which had been drawn up by the United Kingdom Alliance, and from which the following are extracts:

"It is a most remarkable circumstance that persons given to drinking have been swept away like flies. In Tiflis, containing twenty thousand inhabitants, *every drunkard has fallen*—all are dead—*not one remains.* Dr. Sewell, of Washington, said that 'of two hundred and four cases of cholera in the Park Hospital (New York), only *six of the persons were temperate*, and *all these recovered*, while *one hundred and twenty-two of the others died.*' At Montreal, after twelve hundred had been attacked, it was stated in the public journals that 'not a drunkard who has been attacked has recovered of the disease, and almost all the victims have been at least moderate drinkers.' Dr. Bronson, writing from that city, said: 'The disease has searched out the haunt of the drunkard, and has seldom left it without bearing away its victim. Even *moderate drinkers* have been *but little better off.*' So strong is my opinion on this point, that were I one of the authorities, and had the power, I would placard every spirit shop in town with large bills containing the words—"Cholera sold here." So strongly convinced were the Board of Health in the city of Washington that an open liquor shop was nothing more nor less than a 'cholera nest,' and that the sale of liquors 'exposed the people more than all things else to this disease, that they assumed the responsibility of declaring that grog-shops were nuisances, and they closed them for three months.'"

It was resolved to refer the document to me, and I submitted a report from which the following is an extract:

"I do not hesitate to say that the present epidemic has shown that intemperance is a strong predisposing cause of cholera. By far the greatest daily number of cases has been on Mondays, because the Saturday night and Sabbath have been spent in debauchery by the improvident classes, and several of the victims have been very intemperate. However, the placard of the United Kingdom Alliance

greatly exaggerates this influence, as many of the victims have been children, who of course did not partake of intoxicating drink, and women, who have done so in a much less degree than men. Uncleanliness and overcrowding have been much more powerful predisposing causes of cholera, as they also are of drunkenness, for the public-house is a tempting resort from a close, filthy, and overcrowded room. Efforts, therefore, to improve the wholesomeness of the dwellings of the poorer classes are the most practical and efficient means of promoting temperance. With reference to the placard itself, I could not advise its circulation, as I do not believe the statements I have italicized in the copy supplied to me. In any further recommendations which I may publish by direction for the Sanitary Committee, I will continue to warn the poor against intemperance, more especially while our city is afflicted with cholera."

The Alliance, however, persevered, and alarmed our citizens by the poster on every dead wall.

The late Dr. Miller compared the action of alcohol to the screw which urges the oil-lamp, as you can raise the wick and cause a bright flame, to the loss of the wick; but the comparison does not hold good, for alcohol, if not a fuel to supply combustion in the human body, is certainly an agent to prevent the burning of other fuel within it. Another hit at alcohol I must confess my anatomical experience contradicts—it is that so great are its preservative powers, "that the brain of an intemperate man needs no preparation for the dissecting-room, and will keep for an astonishing length of time," therefore say they, alcohol prevents the digestion of food. It may be well to allude briefly to the composition and properties of a few of our usual alcoholic drinks. Beer contains about five per cent. of alcohol, and about the same quantity of starchy matter, which may be reckoned as food, and but half-a-part per cent. of albuminous or tissue-producing food. This drink will therefore increase weight, and its bitter principles certainly increase appetite, but if taken in excess gouty and bilious complaints very readily arise, and an unhealthy bloated fatness is produced. Brewer's draymen, who drink much beer or

porter, are well known at every hospital to suffer from gangrenous and suppurating sores on the least injury being received. The hops are supposed to be tonic, but many bitters, and cheaper bitters, might be substituted. Pale ale contains much less saccharine matter, and the peculiarity of those made in Burton is said to depend on the presence of much sulphate of lime in the water, which does not extract the sugar from the malt.

With regard to wines, the strength of various kinds, and even specimens of the same kinds, is most uncertain, the amount of alcohol varying from some 5 to 13 per cent. in champagnes, to 16 to 25 in sherries. Dr. Hoffman found the sherries in the Queen's establishment to be of only the first-named rate. The chief value of wine consists in the salts of the vegetal acids, which give it high anti-scorbutic properties, and it can never be considered so hurtful as ardent spirits, although we cannot regard it, with Sanctorini, as the "milk of old age." The proportion of alcohol in whiskey, gin, and brandy, varies from 50 to 60 per cent., while rum averages some 10 or 15 degrees higher.

With regard to the effects of spirits on the human race, Prof. Parkes truly observes, "the misery which the use of alcohol produces is so great that it may be truly said that if alcohol were unknown, half the sin, and a large part of the poverty and unhappiness, would disappear from the world; nor does any one entertain a moment's doubt that the effect of intemperance in any alcoholic beverage is to cause premature old age, to produce or predispose to numerous diseases, and to lessen the chance of living very greatly. If spirits neither give strength to the body, nor sustain it against disease—are not protective against cold and wet, and aggravate rather than mitigate the effects of heat—if their use, even in moderation, increases crime, injures discipline, and impairs hope and cheerfulness—if the severest trials of war have been not merely borne, but most easily borne,

without them—if there is no evidence that they are protective against malaria or other diseases—then I conceive the medical officer will not be justified in sanctioning their issue under any circumstances." The mortality of persons who are intemperate between the ages of 21 and 30, is five times greater than that of those who are abstemious.

Of the spirits used in these countries gin is by far the most injurious, because of its exhausting effects through the kidneys. Rum, from the sugar it contains, supports the heat of the body and is the least injurious.

Besides the evils which strong drink produces on the people, it must be remembered that the money expended on its purchase is most enormous, exceeding, in fact, the imperial taxation of the kingdom. If the sum were saved, it would suffice to banish pauperism. Wherever alcoholic drinks have become the habitual beverage of a nation, crime and pauperism have resulted, and the consumption of them is proportioned to the facilities which exist for procuring them. These are the facts on which the United Kingdom Alliance ground their arguments for a permissive bill to allow the majority of the ratepayers in any place to take measures prohibiting the sale of intoxicating drinks. They appeal to the Public Health Act of 1848, and the acts for suppressing lotteries and betting-houses, as being greater encroachments on the liberty of the subject, which were wise, and followed by the best results. That good citizen, James Haughton, is, of course, ecstatic in its favour: "This constitutional mode of dealing with an acknowledged evil of immense magnitude is, indeed, a bright and cheering light on our horizon. The manufacture and common sale of intoxicating liquors have always been looked upon as occupations dangerous to the well-being of society. They have ever been hedged round with limitations and regulations, such as are unknown in trades really beneficial to the community. Such limitations and regulations being

found by experience utterly inefficacious, the "Permissive Bill" is but the logical sequence of those innumerable acts of parliament passed since the reign of Elizabeth, to moderate the tide of misery ever flowing from the liquor traffic."

Dr. Mackesy, ex-President of our College, has most ably advocated the establishment of reformatories for dipsomaniacs, or drunkards, under legal restrictions similar to those which govern lunatic asylums. The patients either to be admitted voluntarily or by order of magistrates, after due medical testimony and inquiry. The writer of the most temperate article on teetotalism I have met, in the *Journal of Social Science*, July, 1866, sums up as follows: "Intemperance is, by universal assent, pronounced the greatest vice of our age, and its effects obstruct the path of the reformer in every field of labour. The general use of intoxicants is sanctioned by the example of the good, and the educated, and the wise. If its use were confined to those who, by their excesses, bring burthens upon the State, the system could not last a year. It is not the habits, tastes, and inclinations of the vulgar which sustain the practice of drinking, but the example of the intellectual, the well-conducted, and refined. The drinking habits of the country do not acquire respectability through the inebriate, but through the moderate drinker. This drink is consumed by all classes, under the belief that it is a good and nutritious article, necessary to sustain health, or at least a source of innocent enjoyment."

In order to show that such repressive measures are beyond the function of legislation, Milton has been quoted: "Next, what more national corruption, for which England bears ill abroad, than household gluttony? Who shall be the rectors of our daily rioting; and what shall be done to inhibit the multitude that frequent those houses where drunkenness is sold and harboured? Our garments also should be referred to the

licensing of some sober workmasters, to see them cut into a less wanton garb. Lastly, who shall forbid and separate all idle resort, all idle company? These things will be and must be, but how they shall be least hurtful, how least enticing, herein consists the grave and governing wisdom of the State." Very great advantage would accrue from the closing of public-houses on Sundays in the same way as other shops. It would tend to increase religious observance of the Sabbath, which by too many of the poor is spent in the tavern, their wages being then in their hands; and Monday is often not a day of work from the effects of the previous day's debauch. The closing of these houses on Sundays in Scotland, and in the dioceses of Cashel and Ferns, has been so beneficial, that an influential association has been formed in this city for the purpose, and great numbers of respectable vintners will support the movement. There cannot be a doubt that if sanitary measures, especially including efforts to improve the dwellings of the working classes, had been made some fifteen or twenty years earlier, the glorious labours of Father Mathew would have borne fuller fruit than they have done.

"I think," says Prof. O. W. Holmes, "you will find it true, that before any vice can fasten on a man, body, mind, or moral nature must be debilitated. The mosses and fungi gather on sickly trees, not thriving ones, and the odious parasites which fasten on the human frame, choose that which is already enfeebled. There is no fancy in saying, that the lassitude of tired out operatives, and the languor of imaginative natures in their periods of collapse, and the vacuity of mind untrained to labour and discipline, fit the soul and body for the germination of the seeds of intemperance. Whenever the wandering demon of drunkenness finds a ship adrift, no steady wind in its sails, no thoughtful pilot directing its course, he steps on board, takes the helm, and steers straight for the Maelstrom."

Tippling is the peculiar fault of his countrymen, and this is not to be wondered at when a strong spirit was detailed in the Western States at eightpence a gallon. Its recent rise in price may be attended with salutary effects.

We are given the credit for being a more drunken nation than we are; it has been found by analysing the revenue returns that England consumes twice as much, and Scotland nearly twice as much spirits per head as Ireland. With us a little drink "goes farther," owing to our excitable and underfed condition. The consumption of alcoholic drinks is however rapidly increasing since 1852, and even then it was nearly double that of 1842.

The non-alcoholic beverages are so well known that scarcely any allusion need be made to them. Tea and coffee are certainly stimulant without subsequent depression, and they invigorate the system against fatigue, cold, and the inroads of disease, while cocoa is nutritive in a higher degree. They contain a similar active principle, thein or caffein, and it must not be forgotten even by teetotallers that this matter, extracted from the beverage they laud so much, is poisonous in large doses. Dr. Lankester killed a frog with half a grain of it, the creature being first paralysed and then convulsed before death. Thein and kreatin, one of the principles of meat, are very similar, and both seem to have invigorating power irrespective of their nutritive value: about 2 per cent. of coffee or tea consists of this active ingredient. Dr. E. Smith epitomizes the subject thus:

"*Tea is useful* to the corpulent, the over-fed, after a full meal at the end of the day when the food has accumulated in the system, when digestion and other vital changes proceed slowly; for the old, for hot climates, for the sedentary, for those who do not perspire freely, for those who eat much starchy food, for soldiers on the march in hot climates; and as a restorative in cases of drowning, or wherever it is desired to increase the respiratory functions. *Tea is hurtful* in the absence of food, after a long

fast (as at breakfast) to the poor and ill-fed, the spare, and the young. It is not adapted to sustain exertion, to prison dietaries, to low temperatures, or to hot climates when the appetite is defective and the skin active, or to those who perspire too freely; neither should it be taken with our principal meal."

It has been well remarked that of all evils which afflict us, those that are cumulative or gradual are the most dangerous, because they are insidious, and therefore less preventible, their cause being obscure. Such an evil of vast magnitude is the adulteration of food and drugs, which, by excluding nutritive or medicinal substances, or introducing those that are injurious, does harm both negatively and positively. "*Caveat emptor*" is, however, the spirit of most of the earlier legislation on this subject, and to many the motto seems to convey a sufficient remedy; but when it is remembered that most of these adulterations cannot be detected with our unaided senses, but require considerable scientific knowledge, some legal protection is indispensable, especially in the case of the poor. As an example of the universality of adulteration, I shall quote a paragraph from the work of our countryman, Dr. Hassall, who has made the subject exclusively his own. After giving a list of deleterious articles used for adulteration, he says:

"It may so happen, and it doubtless does sometimes occur, that the same person, in the course of a single day, receives into his stomach some eight or ten of the articles above enumerated. Thus, with the potted meats and fish, anchovies, red sauces, or cayenne, taken at breakfast, he would consume more or less bole Armenian, Venetian red, red lead, or even bisulphuret of mercury. At dinner, with his curry or cayenne, he would run the chances of a second dose of lead or mercury; with the pickles, bottled fruits, and vegetables, he would be nearly sure to have copper administered to him; while if he partook of *bon-bons* at dessert, there is no telling what number of poisonous pigments he might consume. Again, in his tea, of mixed or green, he would certainly not escape without the administration of a little Prussian blue, and it might be worse things; if he were a snuff-taker, he would be pretty sure to be putting up his nostrils from time to time small quantities of either some ferruginous earth, bichromate of potash, chromate of

lead, or red lead; finally, if he indulged himself with a glass or so of grog before going to bed, he would incur the risk of having the coats of his stomach burned and irritated with the tincture of capsicum or essence of cayenne. If an invalid, his condition would be still worse; for then, in all probability, he would be deprived of much of the benefit of the skill of his physician through the dilution and sophistication to which the remedies administered for his relief were subjected. This is no fanciful or exaggerated picture, but one based upon the results derived from the repeated analysis of different articles as furnished to the consumer.

That the definition of the word "food" is somewhat unsettled, would appear from the recent decision of a London magistrate. A fellow was summoned for selling as ketchup a decoction of putrid horse liver. The justice dismissed the case, being of opinion that ketchup was not food! An appeal to the superior courts is not yet decided.

The addition of water to malt liquors was so great in London that the late Dr. Normandy found beer sold at the publicans 50 per cent. weaker than that at the brewers with which it was professed to correspond, and the drinkers of that beverage must feel still more uneasy when they read the offer of a candid and ingenious advertiser in the *Times*, to enable brewers to manufacture it "without stock or outlay." "The advertiser's many testimonials," it is added, "will vouch for the above, and for having effected economy generally, independently of saving 5 per cent. in malt, imitating beers in vogue, restoring and applying sour beers, without exposure, detection, sediment, or delay, leaving brightness." Some of these foreign substances which are found in so many foods are plainly deleterious; but on the other hand, the public mind has been often needlessly alarmed by chemical analyses announcing the presence of poisonous agents, which, however, were present in such infinitesimal quantity as to be entirely harmless. In this city the Corporation has wisely appointed an able analyst,

Prof. Cameron, and for a charge of 2*s*. 6*d*. any citizen may have any article which he suspects carefully examined. In order to prosecute any seller of an adulterated article, the buyer must give him the option of going with him to the laboratory to see that the article is not exchanged. The following are a few of the results obtained by Prof. Cameron. Since 1862, over 100 specimens of milk have been analysed, and nothing but water found to have been added as an adulteration. This ranged from 20 to 45 per cent. above the natural amount. Sugar was not found adulterated, but it contained frequently iron, which blackened tea and the sugar mite. Filtered or white sugar is now universally preferred. Coffee was found badly ground and stale in many cases. In one case a mixture sold as coffee was proved to consist of roasted wheat, cocoa-nut, dust, and 5½ per cent. of millstone grit, no coffee whatever being present. The vendor was convicted before the Lord Mayor. Spirits were only weakened. During the present year Prof. Cameron examined about 80,000 lbs. of meat, 25,000 lbs. of which was condemned, chiefly because it came from diseased animals. Trichina was never present. Forty samples of foods were examined during the same period, and in many cases a very satisfactory result followed—namely, that the article was supplied to the person or institution complaining, of a much better quality afterwards. In Paris, tradesmen convicted of selling adulterated articles are obliged to post up in their shops a record of the conviction, the penalty, and the time during which this public notification is to be given. It has had the best effect, milk and other articles being supplied of much better quality than with us. It is the duty of the authorities in charge of the departments to fix some standard beyond which extraneous matters become positively hurtful; and from the physician who has witnessed the injurious effects of these hurtful matters in many instances, can alone reliable data be obtained for

instituting such a legal criterion. The great attention paid to the subject of adulteration for the last few years has had the beneficial effect of improving the quality of such articles as confectionery and sweetmeats, and may have had something to do with the vast increase which has occurred in their manufacture. The quantity of such products made in the United Kingdom in 1855 was only 8,000 tons, it now exceeds 25,000 yearly.

In a former lecture I alluded to some effects which were due to the introduction of too great a quantity of tissue-producing food, and I stated that such results were rare, as we are soon made aware of, at least, any sudden excess of such food. The same cannot be said of heat-producing food, for if it be used in excess of the requirements of the system, it becomes stored up under the skin and in the abdomen, and the evils of corpulence follow. Fat is so bad a conductor of heat that, in being deposited under the skin, it fulfils the same purpose as if it were submitted to combustion—namely, the preservation of the body at an equable temperature of 100°, one nearly always above that of the surrounding air. When heat-producing food is supplied in excess, the surplus not being burned off, is loaded at first under the skin, and by the unwieldy condition it gives rise to, exercise becomes difficult and fatiguing, and thus produces disease. From the fat which the blood-vessels pour upon them, the muscles become infiltrated with oil—a condition most readily seen in the flesh of the over-fed and stall-fed ox. A fully-fed ox has been found to consist of fat to the extent of half its weight, notwithstanding the low specific gravity of that substance. There is a muscle on which life is more dependent than almost any other organ in the body, I allude to the heart; and if fat is laid upon it, it becomes so encumbered that its healthful action is much impeded; but the more dangerous condition, fatty heart—a professional term which has become to a great degree popularized, is often found in the leanest, and

depends on a morbid conversion of its substance into fat, and not on a mere deposition. The fibres of the heart become just like those of stall-fed meat, which I showed you in my sixth lecture, and I contrasted them with those of healthy muscle. It is curious that the deposit of fat at the edge of the transparent coat of the eye indicates this serious disease, and for this reason is watched for in examining lives for insurance. The subject of obesity or corpulence has become so "fashionable," and so constant a matter of consultation and of table-talk, that I must discuss it for a few moments, and in doing so I cannot avoid analysing Mr. Banting's profitable, though but sixpenny, pamphlet. This person, a retired cabinet-maker, some 68 years of age, 5 feet 5 inches high, and 202 pounds, or 14 stone 6 pound weight, not being, as he says, "quite insensible to the sneers and remarks of the cruel and injudicious in public assemblies, public vehicles, or the ordinary street traffic; nor to the annoyance of finding no adequate space in a public assembly, if he should seek amusement or need refreshment" and not being able to "stoop to tie my shoe, so to speak, nor attend to the little offices humanity requires, without considerable pain and difficulty, which only the corpulent can understand; I have been compelled to go down stairs slowly backwards to save the pain of increased weight upon the ankle and knee-joints." He joyfully tells us that by the regimen I shall just now quote to you he reduced thirty-five pounds (or two and a-half stone) in thirty-eight weeks, and became free from all the troubles he so bitterly complained of. He extravagantly lauds the surgeon who suggested the remedy to him, urges all fellow-sufferers to consult him, and that they may have need to do so he mentions that some medicine, or, as he describes it, "the balm of life in a wineglass of water—a most grateful draught, as it seems to carry away all the dregs left in the stomach after digestion," is part of the cure.

The name of this miracle-worker was at first only to be learned by letter, but in a subsequent issue he gives the name in full, and it is one which is very familiar to the readers of the advertising columns of the daily newspapers, and notwithstanding Mr. Banting's anxious endeavours to show the contrary, the whole affair seems very like a "doctor's puff." His generosity, however, seems profuse, for he has issued an appeal to the public for the erection of an hospital, to be named the "Middlesex County Convalescent Hospital," and as a thank offering for himself, Mr. Banting heads the list with the very handsome donation of £500. I shall quote his dietary *verbatim*: "For *breakfast*, I take four or five ounces of beef, mutton, kidneys, broiled fish, bacon, or cold meat of any kind, except pork; a large cup of tea (without milk or sugar), a little biscuit, or one ounce of dry toast. For *dinner*, five or six ounces of any fish but salmon, any meat except pork, any vegetable except potato, one ounce of dry toast, fruit out of a pudding, any kind of poultry or game, and two or three glasses of good claret, sherry, or madeira—champagne, port, and beer forbidden. For *tea*, two or three ounces of fruit, a rusk or two, and a cup of tea without milk or sugar. For *supper*, three or four ounces of meat or fish, similar to dinner, with a glass or two of claret. For *nightcap*, if required, a tumbler of grog (gin, whiskey, or brandy, without sugar), or a glass or two of claret or sherry." Now, you will see that in this generous bill of fare, which, almost ignoring the question of quantity, aims at excluding heat-producing food, there is nothing new, and that a similar one would have been prescribed by any scientific or judicious practitioner for similar circumstances. I will not criticize the style of the pamphlet, for its author lays down all pretensions to elegance of diction at an early page; but I think after two or three editions it might have been freed from such palpable errors as talking of the saccharine matter of butter, &c. Although from

sudden, ill-advised, and excessive adhesion to the plan, injury has resulted—for remember great loss of weight must indicate the removal of some heavier material than fat—I think, on the whole, good has been done by this *brochure*, for it has drawn attention to the hygienic questions connected with food. The cure of corpulence is then easy, if the obese be not infirm in will, as has been asserted, and depends on forcing the system to burn off the heat-producing food or fat already accumulated, by denying any further supply of starchy, saccharine, or fatty matters, such as potatoes, turnips, sugar, and sweetmeats, fermented liquors, fat meat, or butter. Such a regimen is surely easier than taking large potations of vinegar, from which bad results have followed; but *embonpoint* is too much dreaded even by the softer sex, and therefore with Lewes I would say, "Young ladies, be boldly fat; never pine for graceful slimness and romantic pallor; but if Nature means you to be ruddy and rotund, accept it with a laughing grace which will captivate more hearts than all the paleness of a circulating library." One more hygienic remedy I would insist on—namely, cleanliness, so as to engage our third lung, the skin, in the removal of fat. Some persons who have been using such an altered dietary as I have detailed, remark that they can bear hot oppressive weather much more comfortably. It is astonishing how long fat animals will bear starvation; a fat pig which was confined under a fallen bank of chalk, was found alive at the end of 160 days, but it had lost 120 lbs. in weight. Thinning rapidly is really a serious diseased condition, and is too often owing to imperfect mastication of food which is generally wanting in fat or starchy material, and the cure is often easy if they believe in these facts. Individual peculiarities however, especially restlessness of mind, will keep some persons thin, feed how they may.

In looking for examples of diseases produced by scanty food, deficient especially in nitrogenous ingredient, I

regret to say we need not to go from home, for in the famine years we had sad experience, and even to this day many ailments of our agricultural peasantry depend on their unvaried and very starchy diet. Hunger, although a universal feeling of man, has not been satisfactorily accounted for by physiologists. Mere distension will relieve it, we are told, in the case of those who eat clay for the purpose. When sufficient food is withheld, man rapidly wastes, the fat first, the nervous tissue last, and their *debris* is carried through the lymphatic vessels, the body actually living on itself. Death occurs the sixth day, or as soon as the loss of weight equals two-fifths.

Thirst is not a feeling of the mouth and throat, no more than hunger is of the stomach alone, so that it was said a man might be hungry without a stomach, and thirsty without a throat. It is worthy of note that an equal weight of ice or of tepid water are far superior to cold water in the power of slaking thirst. You have been, perhaps, in the habit of regarding dyspepsia as the rich man's torment, but every dispensary physician will tell you that half his cases consist of that unpleasant malady. It has been said that "at forty a man is either his own physician or a fool," but this pre-supposes knowledge of the principles of health which is not possessed by our humbler people. The digestive organs become deranged by the great bulk of potatoes which must be used in order to extract sufficient nutriment from them; thus ten or twelve pounds was considered a fair average daily quantity for a working man. Acidity is readily produced from so much starchy food, and heartburn, or waterbrash dependent on this cause, is very frequent among the potato-fed poor, as was also dropsy of the abdomen. The author of "Rab and his Friends," tells of a mode of cure which many other physicians have found efficacious:

"One day a labouring man came to me with indigestion. He had a sour and sore stomach, and heartburn, and the waterbrash,

and wind, and colic, and wonderful misery of body and mind. I found he was eating bad food, and too much of it; and then, when its digestion gave him pain, he took a glass of raw whiskey. I made him promise to give up his bad food and his worse whiskey, and live on pease-brose and sweet milk, and I wrote him a prescription, as we call it, for some medicine, and said, 'Take *that*, and come back in a fortnight, and you will be well.' He did come back, hearty and hale—no colic, no sinking at the heart, a clean tongue, and a cool hand, and a firm step, and a clear eye, and a happy face. I was very proud of the wonders my prescription had done; and having forgotten what it was, I said, 'Let me see what I gave you.' 'Oh,' says he, 'I took it.' 'Yes,' said I, 'but the prescription.' 'I *took it*, as you bade me. I swallowed it.' He had actually eaten the bit of paper, and been all the better of it; but it would have done him little, at least less good, had he not trusted me when I said he would be better, and attended to my rules."

Perhaps the homeopathists will argue that the iron of the ink with which the prescription was written wrought the cure!

Our poor are so ignorant and careless in the matter of cooking that they do not half boil the Indian meal, and it escapes the digestive organs, and is a fruitful source of the dyspepsia still so frequent among the poorer classes. I think that in many cases of indigestion and irritability of the stomach a little solid food is preferable to slops, for it is more in accordance with the habit of the organ, the difference according to disease being in quantity not quality. When a considerable number of the annual reports of the Registrar-General are published, I feel confident we shall find consumption more frequent in this than in most other countries. I think poor diet most strongly promotive of this disease. Scrofula was scarcely known among the New Zealanders till the potato became their staple food—it is now most prevalent. Rickets, another scrofulous disease, consisting in a want of lime-salts, must be a frequent consequence of potato diet, as that root contains but a trifling quantity of lime and magnesia. Ophthalmia is very frequent in this country, producing a large propor-

tion of blindness—namely, 1 in every 843 of the population; in the United States, where the food is highly nitrogenous, the ratio is but 1 in 2,489; and in Norway, where it is very oily and starchy, 1 in 540, the greatest proportion of any country which we are aware of, of those which have a system of vital statistics. Females and children are more subject to ophthalmia than males, and this, as well as the high general ratio, I think can be explained by the very unnitrogenous food of our peasantry, and the very unvaried dietaries of our poor-houses. It should never be forgotten that in Magendie's dogs thus fed, or the Hindoos subsisting on rice and rancid butter, the transparent coat of the eye was always the first to die, being itself very highly nitrogenized and not freely supplied with blood. I have before mentioned the dependence of fever upon insufficient food, and I believe that it acts as follows:—It depresses the stamina, and as the introduction of new tissue material expels the old, the waste matter will accumulate in the blood of the ill-fed man, who becomes from these two conditions more susceptible of the contagious diseases, and less able to bear their exhausting effect. So convinced was Dr. Graves of the curative effects of food in such cases, that he never ceased to preach and practise the doctrine, and often said the most suitable epitaph for him would be, "He fed fevers."

I accuse the potato, or any starchy food which may be substituted for it, of being promotive, along with some concurrent causes, of one other disease—rheumatism, which is very frequent, especially in its chronic form, among the poor of this country. This disease is believed to be due to some acid in the blood—lactic it was supposed to be by Dr. Prout, but I have for a long time seen reason to believe it was carbonic acid; but either of them would be yielded by the over-abundant ingestion of starchy or saccharine food.

Scurvy, the next disease produced by scanty or im-

proper food which I shall refer to, is one now rather of historic interest, having been the most prolific of all causes of death at sea. While the scientific principles on which the victualing department of the navy is conducted have banished the disease from that service, it pretty often appears in merchant vessels owing to the culpable neglect of the owners. Cook's voyage, in which 112 men were out for 113 days with the loss of four men only, and that not by scurvy, proved a strong contrast to Lord Anson's voyage. Vegetables, sugar, malt, portable soup, and lemon-juice led to the immunity, other wholesome practices being added. That the seat of the disease is the blood, and that it is due to a want of its proper materials supplied as food, are the two most positive facts concerning it which we are possessed of. That potash is the deficient material was an opinion started by Dr. Aldridge of Dublin, and forcibly supported by Dr. Garrod, who explains the preventive powers of lemon-juice by the fact of its containing citrate of potash, and the efficacy of vegetables by their possession of this alkali. Some alkali is necessary for the blood, as the burning of such substances as sugar, the great supporter of heat, is dependent on the presence of that agent, and also for keeping the albumen fluid yet incapable of oozing through the coats of the vessels. A solution of albumen, and such we may regard the blood, will take forty-nine times as long to pass through an animal membrane as solutions of hydrochloric acid. The copious oozing of blood, or of some of its component parts, in cases of scurvy has some connexion with these facts. This question I have discussed at more length in my "Manual of Physiology and Disease."

Prof. Parkes has given several sound reasons for the belief that a deficiency of lactic acid and vegetal acids, the salts of which yield carbonates in the blood, is the real nature of scurvy. Carbonates themselves would be useful, but fresh vegetables, rare meat, and lemon-juice are more agreeable and thoroughly reliable

preventative and curative agents. The Merchants' Shipping Act in this particular seems to be, for want of inspection, a dead letter, and it is much to be desired that a judicial inquiry should be held on every case of death by scurvy in this kingdom. Mr. Simon forcibly remarks:

"This fragment of the science of preventive medicine is now well known to all the world. It was scurvy which used to decimate our navy, and rendered long sea voyages almost impossible; it was mainly by scurvy that Anson in his celebrated voyage of 1740-2 lost, within the first ten months, nearly two-thirds of his crew, and during the remaining period about half of the survivors; and it was against scurvy that Cook had attained his triumphant success, when in 1775, after three years' absence, he brought back a healthy crew which out of 112 men had lost only one by disease. Cook's great example gradually got to have its due weight. Twice, indeed, in the next 20 years, our royal fleet had scurvy enough to endanger its existence. But then the better knowledge and better practice began to make effectual way. The year 1796 was (says Sir Gilbert Blane) marked 'as an era in the history of the health of the British navy' by the general introduction of lemon-juice; and an illustration of the effect of this change is that at Haslar Hospital, which even in the year 1780 received 1,457 cases of scurvy, scurvy is now an almost unknown disease."

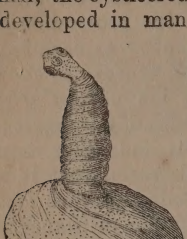
In the Admiralty lemon-juice, Prof. Galloway has found ninety-one grains of pure phosphoric acid, and thus may be supplied the deficiency of phosphoric acid which is abstracted from meat by the old, and I trust exploded, system of salting. Phosphorus is found in some form in the following components of our bodies—blood, muscle-juice, gastric juice, bones, brain, and other solid organs; and any deficiency in the supply of it must lead to most injurious consequences upon each of these. The blood and juice contained in the flesh are prevented from oozing the one into the other during health by the alkaline state of the former and the acidity of the latter, and both these properties are dependent on phosphoric acid, combined in the case of blood with an excess of soda. The oozing out of blood and the muscular debility which are two most prominent symptoms of scurvy, may be now readily

explained. A dusky hue of skin, coldness, palpitation, and other signs of impeded breathing which occur in the disease, may be due to a want of phosphate of soda, which is of essential importance in bringing carbonic acid to the lungs, and even the softening of bones and the separation of their ends, and lastly, the prostration of nervous power, seem capable of a similar explanation. Such arguments are advanced by Prof. Morgan to show the superiority of meat prepared by his process over salted provisions in preserving the health of our seamen.

The effects of decomposed sausages and other meat have been sometimes so sudden and fearful that it is supposed a special poison is developed, and such food would appear to have the effect of lowering resistance to contagious diseases, for the Faroëse, who indulge the depraved taste of putrid meat, are mowed down when measles or small-pox is once imported. Meat slightly tainted can be sweetened by boiling the joint with three or four ounces of charcoal.

Some of the diseases which infest the animals we consume as food are capable of producing serious consequences to man if their flesh is partaken of. Sheep, it is well known, suffer much from "flukes" in the liver, and this parasite is transferable to man if the liver be eaten. The flesh has not been shown to be unwholesome, but the liver is so disgusting that it is surprising it could ever be sold as food. The animals cannot be cured, but the disease may be prevented. This rot in sheep rapidly spoils the value of the animal and the food it affords for man. Prof. Simonds says: "In many parishes in Devonshire, where I investigated the malady, five-sixths of the sheep perished or were sold for a few shillings each, for slaughtering, to the detriment of the health of the poorer classes," and Dr. Bellingham of St. Vincent's Hospital was one of the first writers to notice the injury to sheep which the filaria produces by lodging in their lungs, stomach, and intestines. Prof. Gamgee estimated

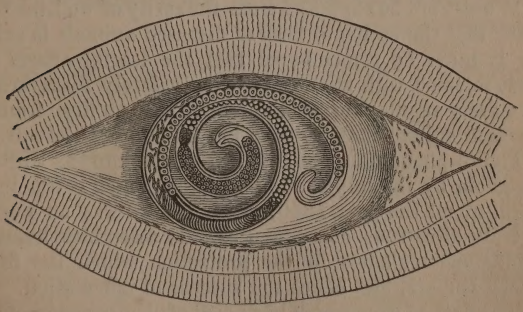
that half-a-million of sheep were affected by it, in 1862, in the United Kingdom. In the pig the disease termed "measles," and recognized by knowing buyers by small blisters which form under the tongue, is due to an animal, the cysticercus, lodging in the flesh, and it becomes developed in man's body into that formidable tenant tapeworm. A measle from the pig is here figured. Measles affected over 2 per cent. of all the pigs, and was still more frequent among the pigs reared in cabins in Ireland some years ago, for reasons which are too disgusting to mention; but an extensive curer tells me it is rare now, since the stock is reared by larger farmers. One tapeworm is capable of producing 85,000,000 of the creatures which produce measles; and if they were not destroyed, measles would soon become a universal disease. The measly carcases are not by any means rejected as they should be, for as the salt gets more readily into the holes the little animals make, they are easily cured. By thorough salting and smoking and careful cooking they would be destroyed, and there is more danger of their being introduced in under-done pork; but to avoid danger to public health, all measly pork ought to be seized. That the measly pork will produce tapeworm in man was shown by inducing a criminal, on gaining a reprieve, to eat plentifully of this food, and in two months his body was infested with tapeworms. In India, tapeworm was common a few years since owing to the filthy feeding of the pigs; and my friend, Dr. Leared, has shown that one-fifth of the deaths in Iceland occur by the same cause; and he suggests that the dogs which are there the great propagators of the parasite should be cured by the medicines which we know surely expel it. Measly or "spotted"



Measle from the Pig.

pork may be known by white specks scattered very thickly through it.

The trichina spiralis is another little creature which may, in a similar manner, find its way into man's flesh, and there give rise to, during its migrations, a fever resembling typhus, but producing awfully severe muscular pains. The great names of Hilton, Paget, and Owen are connected with the discovery of this worm, about 1834, in the flesh of man; and in 1836 six bodies were dissected in this city which contained it. It has since appeared very rarely. It is said to be spread by rats about slaughter-houses, which pigs afterwards devour. Till lately we had no case where, after the fatal result, we were enabled to discover the parasite; and the zeal of one naturalist carried him so far, that for the purpose of examining it, he proposed to "harpoon" one of the muscles of the living patient, and in a bit of flesh so procured, the size of a hemp-seed, seven of the animals were found. In the little Saxon town, Heltstadt, the eating of one pig in October, 1863, produced 158 cases of trichinous disease, and led the English Privy Council



Trichina in Meat.

to scientifically study the subject. In one morsel of flesh, one-fifth of a grain in weight, 58 trichinæ were found, which would give 28,000,000 if the whole mus-

cles were equally affected. The sketch on the previous page, adapted from those of Dr. Thudichum, represents one of the worms containing several eggs and young ones within it, and coiled up in the midst of muscular fibres. The fat of pork, and the heart and other organs may be eaten, as they never contain the parasite. There is nothing new in our restrictions in these matters, for by Edward II. it was enacted that a butcher should not sell swine's flesh "mezzeled," or dead of the murrain. For the first offence the butcher was to be "amercied;" for the second, to have the pillory; for the third, to be imprisoned and fined; for the fourth, to abjure the town. Henry VII. decreed that "No butcher shall kill any flesh in his scalding-house, or within the walls of London, in pain to forfeit for every ox so killed 12*d*., and for every other beast 8*d*., to be divided between the king and the prosecutor." The flesh of animals which have died of anthrax, malignant pustule, splenic apoplexy, ovine small-pox, and other diseases, would be probably most injurious if partaken of by man, but upon this point positive evidence is wanting.

It must not be supposed from the rarity of well-proved cases that the eating of flesh of diseased animals is safe, for it must be remembered that the fearful effects of meat infested with trichina was only lately discovered. The army regulations are imperative that no flesh from a diseased animal shall be used but in civil populations.

Pleuro-pneumonia was first introduced into the United Kingdom by the importation of some Dutch cattle into Cork, about the year 1840, which indeed was an event of truly disastrous consequences. It resembles human contagious maladies in the protection which the first attack confers, and hence the success of inoculation.

The flesh of oxen which have died of pleuro-pneumonia, or contagious lung distempers, is very commonly sold—not by the butchers who supply the richer classes, but by those who, in the wretched neighbourhoods, pawn it on

the poor. In September last, the matter was brought before the Lord Mayor, as the Clerks of the Market had seized the carcases of some beasts which had been slaughtered while suffering from this distemper. Prof. Cameron, the City Analyst, and I expressed our opinion that the food was not fit for human use, but as the question was one touching the interests of graziers very largely, the evidence of the most celebrated chemist in Dublin and of two able surgeons was procured, to attest that they could not discover by chemical analysis or microscopic examination any peculiarity in the meat. We urged that animal poisons are unfortunately not to be discovered by these aids, which are not used in the detection of similar human diseases, and testified that we thought the food of an animal affected with a contagious blood-disease unwholesome, and certainly not as good as that from healthy oxen. The Lord Mayor decided in this case against the Clerks of the Market, but the matter is by no means set at rest.

The following communication, which the Lord Mayor received from Prof. Ferguson, was laid before the Sanitary Committee of the Corporation a few weeks since :

"Veterinary Department of the Privy Council Office.

"My Lord—I am directed to inform you that it has been reported to the Commissioners of Police, on most reliable authority, that almost every night sick and even dead cattle are conveyed in carts to a slaughter-yard in ———, where they are dressed, to be subsequently sold as human food.

"I also beg to direct your lordship's attention to the fact that neither microscopic nor chemical examinations are able, in the majority of cases, to discover any difference between the meat of sound and diseased animals, even when the latter had been found, on careful judicial examination, to have poisoned the persons who have partaken of it. The cases of poisoning at Newtownards in June last, resulting from the eating of the meat of a diseased calf, afforded an example of this fact. According to the sworn evidence of some experts, the meat in question did not differ in appearance from that of a healthy animal, nor could the professional men who examined it discover any poisonous principle in it, although the

evidence that the eating of it had poisoned several persons, and in two instances fatally, was so clear that the coroner's jury brought in a verdict to the effect that the deceased had died from having partaken of poisoned veal, and four of the persons implicated in selling the same are held to bail to appear at the ensuing Downpatrick assizes to take their trial for said offence. It is desirable to add that Dr. Hodges, who analyzed the stomachs of the poisoned persons and their contents, could not discover any trace of poison therein, although there was no doubt that the deaths had been caused by an animal poison contained in the meat of the diseased calf. This may be regarded as confirmatory of the statements recently made by the Corporation's regular medical and chemical officers, Drs. Mapother and Cameron, to the effect that the meat of diseased animals, even when in an absolutely poisonous state, may present all the ordinary appearances as well as the microscopic and chemical characteristics of sound meat, fit for human food, although it should on no account be sold as such, particularly to the poor, whose digestive organs are too frequently enfeebled by habitual privation, and are therefore less able to resist the poisonous influence of food derived from the carcases of diseased animals. Such meat, when given to dogs, as I have frequently stated to your lordship, has a tendency to produce severe diarrhœa, and I respectfully submit to your lordship should not be sold as human food, particularly at a time like the present, when even from comparatively slight errors in diet, the digestive organs too frequently become affected with rapidly fatal diseases, such as cholera.

"It has been argued that cooking destroys all the poisonous principles in the meat, no matter how diseased may have been the animals from which it has been taken; but that such is not the case, has been proved by the fact that some of the veal that caused poisoning at Newtownards had been no less than twice cooked previous to being eaten.

"Apologizing for thus again intruding the subject upon your lordship's notice for re-consideration, and begging the favour of being made aware of your ultimate decision relative to the meat of diseased animals when reported as such, I have the honour to be, my lord, your lordship's obedient servant,

"HUGH FERGUSON, H.M.V.S."

I could add little to Prof. Ferguson's full and truthful report. Lung distemper being a communicable blood disease, must render the flesh of the animal unwholesome, although it may not sensibly alter it; for it must be confessed, that the chemist and microscopist are

equally powerless in the detection of animal poisons. The disease is very similar to human typhus, in which the muscular tissue becomes rapidly broken down and loses its cross marking, and the muscular prostration is often so great, that early in the distemper the beast is not able to stand. If the animal were allowed to die of the disease, its flesh would be still more unfit for food. There are many other cattle diseases which have been ascertained to be communicable to man when the flesh is eaten, and if a vigilant inspection were rendered possible by the limitation of slaughtering to two or three abattoirs, much injury to public health could be prevented. The conveyance of infected cattle to this city, where they are sold—not in the markets, but without commission in the yards of some salesmasters, greatly tends to spread communicable disease among healthy stock; and Prof. Gamgee says that our slaughter-houses are "very improper establishments for the purpose to which they are applied; the putrid emanations are such that meat cannot be long kept in them, or in shops adjoining them." The loss by seizure in the city of London, where inspection is most vigilant, is but $\frac{1}{600}$ of the meat sold, or 2*s*. 6*d*. in every £100, and great good is done to the poor in the way of preventing dangerous food being sold to them. Dr. Letheby, one of the greatest authorities on the matter, says: "The practice in the city of London is to condemn the flesh of animals infected with certain parasites, and of animals suffering from fever or other acute inflammatory affections, or from lingering disease, as well as of animals that have died from natural causes, and all meat in a high state of putrefaction, and meat tainted with physic."

Among the Jews and in Austria there are very stringent rules, and in that country no calf under three weeks old, or weighing less than forty pounds, is allowed to be used as food. In Italy, the milk from cows with foot and mouth disease is not allowed to be sold, but in

cases of more severe disease the secretion of milk is fortunately arrested by nature. In New York great injury has resulted from the use of such milk, and in other States that fluid is said to convey a fatal disease, which the cow contracts from pasture. The argument so often used in opposition to sanitary efforts—namely, that death has not been shown to be produced from this special cause, would equally apply in opposition to removal of some of the filthiest nuisances. Milk rapidly generates fungi and vibriones, and Dr. Parkes suggests that by the decomposition of that fluid, digestive ailments may arise in children, and that the disease known as "thrush" may be connected with them, for fungi are found in the blister that forms. The swill milk, or that from cows fed on distillers' grains and wash, is notoriously unwholesome in New York.

Dr. Letheby believes that many cases of illness are produced by the eating of meat from diseased animals, and during 1861 the sanitary officers of the city of London seized 141,458 lbs. of meat, of which 78,697 lbs. were from diseased animals slaughtered, and 33,619 lbs. from beasts that had died. Prof. Gamgee has seen "a carcase dressed, and portions of it prepared for sale as sausage meat, and otherwise, although thoracic disease had gone to such an extent that gallons of fetid fluid were removed from the pleural sacs, and that large abscesses existed in the lungs." Owing partly to the noxious air which surrounds them, and partly to intemperance which is common, the mortality among butchers is only exceeded by that of one employment, the vintners, according to Dr. Farr.

I have before alluded to the expediency of erecting abattoirs for our city, but I may now state that that erected lately at Fountain-bridge, near Edinburgh, is a model for our guidance, and not a slaughter-house exists in that city. The premises of the abattoir cover four and a-quarter acres, thus affording space for all the

accessory trades. The measure is since 1765 established in Paris. In the year 1810, Napoleon, moved by a report of the Institute, of physicians, and by complaints of citizens, issued his celebrated decree of the 15th October, regulating the position and management of all industrial establishments under three heads, according to the extent of their insalubrity or inconvenience. First, those which ought not, on any account, to be carried on in towns; the second, those which, though not absolutely forbidden, ought only to be sanctioned when the processes are conducted so as not to be injurious or inconvenient to the neighborhood; the third, those which may be placed in any part of the city. Foremost among the first class were placed abattoirs, slaughter-houses, knackers' yards, and other businesses concerned with the flesh, skins, blood, and entrails of animals. Fat melting in Paris is done outside the city, and mainly in the abattoir, in which there are forty-eight such establishments. The Emperor also ordained that all private slaughter-houses in the city of Paris should be closed, and public abattoirs constructed by the municipality outside the barriers.

An excess of flesh-producing food does not give rise to such evident ill consequences as we have seen an over-amount of heat-producing material does; but if combined with such concurrent influences as sedentary habits, gout, produced by the accumulation of a nitrogenous acid in the blood, is sure to follow. I have not been able to produce any statistics on the point, but I feel sure that butchers are more subject to apoplexy and enlargement of the heart than most other men, unless the ill effects of over-feeding be prevented by free exercise.

Good food has a peculiar power in preventing parasitic skin diseases, as rich blood does not seem suitable soil wherein they may thrive. I think that the great rarity of scald-head, which depends on a little plant,

may be explained by the improvement in the food of the peasantry which has of late years occurred.

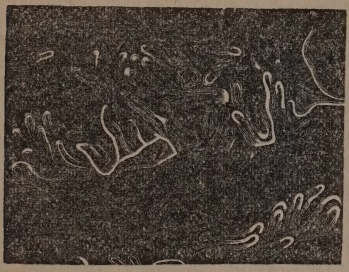
The subject of the diet advisable in various diseases is not suitable for a popular audience, but I have long intended to publish for my professional brethren some principles on the subject, which I think, nearly as much as medicine, influence the recovery of the sick.

LECTURE IX.

HEALTHY SKIN—BATHS—CLOTHING.

THE most appropriate introduction to what I shall have to tell you of baths and clothing will be, I think, a sketch of the structure and function of that much neglected organ, the skin. It is composed of two principal layers, the scarf skin, which you readily peel off, or which is raised by a blister, and the true skin, containing the means by which we feel, and the glands which throw off perspiration and other matters. The scarf skin is quite devoid of feeling, as you perceive when testing the sharpness of a razor upon your hand, and therefore is placed over the sensitive layer, to blunt this property. It is very impervious to water likewise, and thus prevents the escape of that fluid from the tissues of the body, and being a bad conductor of heat, it prevents the injuries which would result from sudden changes of the temperature. The scales of which the scarf skin is composed are being constantly renewed by the true skin, and those of the surface are cast off, as can be most readily perceived on the scalp, where they go by the name of "dandruff"—which I may parenthetically tell you is derived from two Saxon words signifying "itch" and "dirt"—but after fevers the rest of the body throws off its scarf skin abundantly. The scarf skin is composed of albumen, and thus it is that the soda of which soap is composed is capable of softening or dissolving part of it, and thereby removing the dirt which may have been fixed in it. The thickness of this covering varies with the pressure to which it is subjected, that of the palms of the hands and soles of the feet, and that of the face, being the extremes in this respect, and owing to the scantiness of hair, man's skin is thicker than that of most other animals.

It is in its deepest layer that the colouring matter which distinguishes various individuals and races is situated. The colour of the dark races is of use in tropical climates by absorbing the heating rays of the sun, by which perspiration is increased, and its subsequent evaporation cools the surface. In such climates the skin is very active, and aids the lungs and liver in their purifying operations. The true skin has upon its surface numerous projections, containing nerves, and which are the organs of touch, whereby we are made acquainted with the conditions of external objects, and much danger is avoided. The elasticity of the skin, and the softness of the cushion of fat beneath it, prevents these tender projections from receiving injury when even strongly pressed on. An immense number of blood-vessels permeate the skin, so that the finest needle cannot be thrust in without wounding some. The capillaries of two ridges of the skin are here figured.



The Vessels of Skin.

This great vascularity is promoted by heat or moisture applied to the surface, and diminished by the contrary; so that you will readily understand how the circulation of internal organs can be affected by changes in this outer one. The occurrences, blushing and pallor, show that emotions created in the brain are capable of influencing the circulation in the skin. The glands, or twisted tubes which we find in the skin, are the structures which are most closely connected with the preservation of health, and they are of two kinds—first those short ones which you see represented by the sides of

the hair in the centre of the next diagram, a little animal, which nearly always exists in them, being also seen. They open into the hollow in which the hair is set, and pour out a soft fatty matter, very like ordinary tallow, after it has become solid from its flow outwards being prevented by the blocking up of the orifice. They are large upon the face, and when the contents of a tube is squeezed they assume a spiral form, and being tipped by black dirt have been popularly believed to be a "flesh-worm," but are rather nests of worms, for as many as twenty of the little creatures I have just mentioned may be found in the mass by the microscope. The unctuous matter serves many important offices—it renders pliant the skin, obviates the vicissitudes of heat and cold, and it prevents the injuries which would result from the rubbing together of contiguous surfaces. It must from its highly nitrogenous composition be regarded as waste tissue-matter, from which the blood is purified, and which cannot be retained without injury to health.

Sectional Diagram of Skin.

The longer and more spiral tube to the left of the diagram is that through which the perspiration is expelled. You see it is rolled up into a circular ball at the deeper end, and opens obliquely or in a valve-like way at the pores on the surface of the scarf skin. The magnitude of this system of "drainage tubes" will be best learned

from Erasmus Wilson's calculations; the average number to the square inch of skin may be stated as 2,800, for upon the palm of the hand there were 3,528, and even on the heel, where they are least numerous, 2,268. Taking the surface of an ordinary man as being equal to 2,500 square inches, the number of perspiratory tubes will be 7,000,000 and as each is about one-quarter of an inch long, there will be about twenty-eight miles of this tubing throughout the entire skin. No one will deny that serious results must follow if this drainage system be obstructed, and I will presently offer you abundant evidence of the fact. From these pores there is constantly issuing vapour, which is known as insensible perspiration, and occasionally upon increased exercise, or when chemical change in muscles is more abundant, or during greater heat, it becomes condensed into drops of sweat. The evaporation of this fluid serves the useful physical purpose of keeping the temperature uniformly at 100°, as the conversion of the water into steam plentifully abstracts heat. In tropical countries the colored races are kept cool by the great evaporation of sweat, the heating rays of the sun being absorbed more readily. The giving of perspiration is much checked by a moist air, and thus it is that while Chabert, "the fire king," and Sir F. Chantrey's workmen, could enter a chamber of which the temperature was 400°, the air being dry, could not endure a moist atmosphere of one-third the temperature. Waste matters, the products of the chemical changes of the body, are also got rid of by the perspiratory tubes, as will be seen by the following analysis of sweat:

Water	995·03
Animal matter, including urea	0·10
Sulphates	1·05
Chlorides	2·40
Acetic, lactic, and formic acids, fatty matters, &c.	1·45
	1000·00

The Rev. Prof. Haughton has found no urea or other nitrogenous substance in it.

The daily quantity of sweat has been computed at three pounds at ordinary temperatures; but in such employments as gas-makers and stokers that quantity has been given off hourly, and this without exhaustion, as they are given gruel to drink plentifully. Of solids, including putrescible animal matter, it is computed that 100 grains are daily got rid of when the skin is performing its functions healthily, or much more by the action of a Turkish bath, and the worst results must ensue from its retention in the blood. Even disease illustrates the purifying nature of the skin, and the eruptions which follow the introduction of small-pox and other contagious poisons are but efforts of Nature to free the system from them.

The skin is also a great respiratory surface, and gives off the products of its combustion as carbonic acid, the amount of which is greatly increased by a vegetable diet. If the skin of any animal be coated with an impermeable varnish, the breathing through it ceases, and the animal dies in an hour or two, as effectually suffocated as if its windpipe had been stopped. The compensating action in this regard which exists between the lungs and skin is best illustrated in disease; for instance, when the lung is injured by inflammation of its texture, the combustion and consequent extrication of heat by the skin becomes excessive. As it is quaintly, but not inaccurately, phrased by an old writer, the skin serves to "discharge the fuliginous recrements of the blood, with the steams arising from the subjacent parts, and to ventilate the flame of the circulating blood that it may not be oppressed or suffocated."

The last faculty of the skin I shall allude to, is its power of absorbing various substances placed in contact with it; painters, mirror-silverers, and the victims of cancer-quacks, have been often poisoned by the lead,

mercury, or arsenic introduced through this channel. The scarf skin, and the oily matter with which it is smeared, is, however, a very effectual guard against the absorption of injurious matters and contagious poisons, which would readily gain entrance, as they do through the lungs, if it were not present. However, that animal matters may penetrate has been shown by Mr. Ceely, for he has often vaccinated without scratching the skin, by merely leaving the lymph upon the surface covered with a little blood, and patients who, from diseases of the food-passages could not be fed in the ordinary way, are said to have been supported by baths of milk and soup. The palms of the hands and the soles of the feet allow absorption readily, as no oily matter is spread over these situations.

The skin is also the great medium of sensation, which is accomplished by innumerable nerves and peculiar bodies formed in them; but I will not further allude to this function than to say that we are made aware of changes of temperature, so frequent in this variable climate, and of any hurtful physical condition of surrounding objects, by this endowment of the surface. I trust I have convined you of the prime necessity of carefully attending to the functions of this all-important organ, for I believe that health would be preserved and life prolonged if we ourselves were, as Sir Astley Cooper phrased it, as assiduously "groomed" as our horses. That eminent sanitarian, Mr. Chadwick, puts this fact in a very practical way:

"Skin cleanliness augments the nutritive effects of food. It has been found on positive comparison of results with the same quantity of the same food, that pigs that are subjected to regular skin cleansing by being washed, 'put on' one-fourth more flesh than the pigs that are unwashed, and that the pork of the washed pigs is the finest and the 'best eating.' It should, therefore, be preached to the poor, as an additional inducement to skin cleanliness, that the same food which is required to make four children that are kept dirty thrive, will serve to make five thrive whose skins are daily washed and kept clean."

The very numerous matters which I have stated the skin itself discharges, and the extraneous particles which the friction of our clothes or the dusty city atmosphere—including all those dirts which Lord Palmerston defined as but misplaced matter—soon forms a crust upon this organ which blocks up its openings and otherwise interferes with its all-important functions. The salts which form a considerable portion of this crust attract moisture, so that an unclean skin will be always kept damp, and the waste matters may in this way undergo solution and be re-absorbed into the system. Such animal matters, if refused exit by the skin, will seek removal by the kidneys; but they, however, will fail after a time in fulfilling this work superadded to their own, and that most frequent and fatal malady "Bright's disease," which depends on the obstruction of the tubes of the kidney, often results from a neglected skin, or from the rush of blood to the organ by reduced temperature and suppressed perspiration, as was first shown by the late Dr. Osborne, and which I have many times observed. In the army the want of cleanliness was once most disastrous, and Dr. Rush said that if soldiers grew as rapidly and as spontaneously as blades of grass, uncleanliness would mow them down in a campaign or two. I trust the time will come when, by the improvements of chemical science, the most useful of all the branches of knowledge accessory to medicine, the quality and quantity of the cutaneous exhalations, will be investigated with some of that zeal which has largely added to our knowledge of morbid states of the secretion of the kidneys.

Water, especially that which is soft, as its solvent power for saline matter is greater, removes the crust upon the skin of which I have spoken, with the exception of its fatty matter, and this requires the addition of soap, the alkali of which saponifies it. Soft water is far more cleansing than hard, and is less irritating, as every surgeon finds out in the dressing of sores. Well-made soap

can never be injurious to the most tender skin, even that of the new-born infant, and all wash-powders are hurtful—for, in the words of Mr. Wilson, the greatest authority on the preservation of the skin, they cannot "follow the innumerable apertures of the skin, nor enter the mouths of the pores otherwise than to obstruct them. A skin cleaned in this manner may always be detected by a certain kind of shining, not to say greasy polish, and the whole complexion looks mellowed into a kind of *tone*, as we say of pictures in which dirt and time have softened and chastened the tints." The same able writer, in his admirable treatise, "Healthy Skin," to which I have to acknowledge many obligations, says: "As regards the frequency of ablution, the face and neck from their necessary exposure to the atmosphere and the impurities which the latter contains, cannot escape with less than two saponaceous ablutions in the twenty-four hours; the feet, from the confined nature of the coverings which are worn over them, require at least one; the armpits, from their peculiar formation in reference to the detention of secretions, and also from the peculiar properties of the latter, at least one; and the hands and arms so many as nicety and a refined taste may dictate. No harm can arise from too frequent ablutions, much evil may result from their neglect." I believe the insusceptibility of the face and hands to the influence of chills depends on the frequency of their ablutions. Miss Jane Porter, the novelist, who was always catching cold on the slightest exposure, once remarked to her brother, a physician: "How I wish that my skin were all face." "Try and make it all face," he replied.

The most beneficial of all methods of ablution is the general one easily accomplished by the sponge-bath, the water being at first suited to the season, or to the cutaneous activity of each individual, and no single hygienic observance has perhaps done more to prolong life or preserve health. Those who are ready to exclaim, "We

have not time every morning for bathing," should remember that it can scarcely take five minutes; that there are 288 of these five minutes in the day, and that neglect of this observance will incapacitate them for many a five minutes, when hereafter prostrated by illness. A wet towel nd a dry one to follow will be a good substitute, if time and cheapness press. The ruddy cheek, full pulse, and muscular activity—in a word, the hale old age of many has been justly attributed to the continuous use for years of daily cold bathing. I must also confess that our art can offer no better prescription for those predisposed to be threatened with consumption. The sponge-bath may be made more stimulating by adding common salt, or Tidman's artificial sea-salt, to the water, and should be followed by the vigorous use of a rough towel, such as those called Turkish. Horse-hair gloves are also excellent, and by clapping them together after use, you can prove how much stuff they scrub from your body. A belt of the same material has been found even better than a flannel bandage as a safeguard in cholera times.

The first effect of cold bathing is to make the muscles of the hairs, which are depicted in the diagram of the skin on a previous page, passing obliquely to near the root of one of them, contract, and this is evidenced to us by the goose-skin appearance they produce by erecting the hairs. By the contraction of the blood-vessels of the skin much blood is thrown upon the internal organs, which excites these in their return to act more energetically, and what is known as "reaction" takes place. This consists in a freer circulation, the skin becoming redder and hotter, and the breathing and other vital functions being exercised with greater ease; and unless it follows, health cannot be perfect or the bath suitable. In very cold weather, or in the case of chilly persons, the upper part only of the body may be uncovered at first, washed and clothed with woollen and then the lower half may be treated in the same way. However,

in this and all other hygienic practices, there are many individual peculiarities, as it is impossible to frame precise rules to fit every one's circumstances.

The warm bath is a valuable means of cleanliness, but is relaxing and oppressive, as very little, if any, perspiration or breathing by the skin can occur in water. The temperature should range about 96°, and is unendurable beyond 104°. Of the Russian vapour bath—that is, one in which the air is charged with an opaque mist—I have no experience; but as it would impede cutaneous transpiration, my impressions of it are not favourable, although it is esteemed by many. The hot air bath, arranged with a spirit-lamp under a cradle, is very convenient, and in St. Vincent's Hospital has been found most serviceable. Mr. O'Neill of Henry-street manufactures a most useful and cheap form. If the more carefully constructed bath which I have next to speak of can be procured within a reasonable distance, it should be preferred to all other hot-air kinds.

The baths introduced into this country in 1856 from the East, under the name of the "Improved Turkish Bath," has been regarded as more analogous to the old Roman bath than to the Oriental hammâm. Although a description of it may seem unnecessary, as there must be few, if any, of my hearers who have not undergone its operations, yet that will be the readiest method I can offer my opinions on the subject, making any comments I think suitable at each step. The first room you enter is as cool as the outer air, and here you undress, and afterwards dress again, so that from these circumstances the Romans termed it the *frigidarium* or *vestiarium*. Swathed round the waist by a light cloth, and with clogs to prevent your feet being burned by the heated tile floor, you enter the second room, or *tepidarium*, heated by flues carried under the floor, to from 110° to 120°, as the thermometer in it informs you. The admission of pure air and the expulsion of impure is accomplished by

ventilators in the opposite walls near the ceiling, and unless this is carefully attended to, the hour will be by no means healthfully spent. The windows, fitted with stained glass to produce a tinted twilight, are in the roof, which partakes of that Saracenic character of architecture on which the whole building is constructed. There is a central seat and several couches of marble with mattresses, on which you spread the sheet given to you. Although there is no direct method for charging the air with moisture in this apartment it must enter from the inner room, and basins of water, with which you are advised to wet your hair, the only part which feels hot, are usually left in it. The sensations in this room are agreeable to nearly every one, and those to whom they are not, are probably those to whom, as I shall tell you, the bath is unsuited, and they should retire to the cold room, at least for a while. My pulse usually rises four beats here, and often twenty in the warmest room, and the respiration becomes a little hurried; but these effects diminish when a general perspiration breaks out in some twenty or thirty minutes, and you are thereupon fit to enter the *sudatorium*. The air in this last chamber is heated to about 140°, and is charged with moisture, though not visibly so, from the washing-places which adjoin. In the hammâm, the temperature of one room is over 200°. I think it would be well to have vapour equably distributed by a spray jet of warm water, and regulated by the aid of the hygrometer. Strange enough, the other secretions are not lessened, although so much fluid escapes from the skin. The attendants are so much exposed to a high temperature that they do not require heat-giving food, and lean meat is what they care for. Their employment does not seem to injure their health. I know one fellow who has been about eight hours daily for over eight years in the bath, and he is healthy and muscular. I am very anxious to make some investigations on these and other physiological

points in connexion with the bath, and will seek the leave of the proprietors as soon as I can find leisure. It appears from the writings of Galen that the Romans took care to have the air of the *sudatorium* moist. The heat in this room feels to many oppressive, and with others sweating becomes profuse. The curious operation of shampooing is performed here. You are stretched on a couch, and every part of your body is kneaded, squeezed, rubbed, or pulled till your joints crackle, and become so flexible that you feel they are really being dislocated. So relaxed is the system that these operations, which, under ordinary circumstances, would be intolerable, are really agreeable. A surprising quantity of scarf skin, which no washing could remove, peels off, especially if a glove of camel's-hair or goat's-hair be used, as they are in the East, where also the soles of the feet are scraped with pumice. The deposit of this skin of only a week's date, when collected, is often as large as one's fist. You are then dashed with warm water and lathered with soap applied with a wisp of lyf, the woody fibre of the Mecca palm, and finally washed clean by tepid, and afterwards cold water issuing from a rose with a flexible tube. Adventurous bathers often take a cold douche, or even some, closely copying the Romans, try immersion in cold water "to close the pores," but some means of restoring one to the normal temperature is indispensable. From this *lavatorium* you are rapidly conducted to the first room, where, wrapped in your sheet, you recline on a couch or duretta shaped like a spread out W, till quite cool, when you slowly dress, for any hurry or exertion is apt to bring out perspiration, which makes you liable to catch cold—a properly conducted bath, however, having no such effect.

I would advocate the use of the bath as a social custom and preventive of disease, for I believe it is the most perfect means of ablution we possess, and therefore keeps up a cleanly and vigorous condition of the body, and

braces the person against the vicissitudes of temperature and the liability to catch contagious diseases. There is no doubt also that large evacuations can be accomplished through the skin more safely than by any other secreting organ. Much more solid matter is contained in the perspiration of those who take the bath for the first time or after a long interval. Nothing escapes through the skin, save what is noxious if retained. This bath should never be used in case of advanced lung diseases, great debility, acute inflammations, or persons who labour under any form of heart disease; but on the contrary, I think its influence is directly curative in rheumatic, gouty, and scrofulous affections, some skin diseases, and the earlier stages of feverish colds and ague. It is said to have calming effects in the treatment of insanity, and the use of it was suggested from the heavy smell the skin of persons thus afflicted often has.

By producing freer action of the skin, especially of its aërating function, I feel sure it is preventive of consumption, and curative perhaps in the earlier stages of that malady. It is a substitute, to a certain extent, for active exercise, which the circumstances of some prevent them from enjoying, and in Rome the baths formed part of their great *gymnasia*, those institutions which had so much to do with the training of that hardy and manly race. The importance of baths among the Romans is evidenced by the number and magnificence of such establishments; that built by Diocletian was capable of accommodating three thousand persons at a time—and so highly valued were they, that those who sought power at the hands of the populace could find no more effectual way of winning their favour than opening such establishments gratuitously for a day. In Eastern nations the bath has been, both in ancient and modern times, held in equal estimation, for in the words of Disraeli, "The East is the country of the bath. Moses and Mahomet made cleanliness religion." The Hammâm in Jermyn-

street, London, managed by a company, is the most perfect bath now existing, and corresponds most closely with that of the Turks. In the two years following its erection over 60,000 baths were given. One of its striking features is a douche, constructed of small tubes, with minute apertures, which take the form of a case, in which the body is enclosed, and the water is jetted gradually from the lower to the upper part. There is also a cold bath, which the bather may swim through to return to the cool from the hot chamber. The attendants are Hindoos. It was in favour of this establishment that Dr. Goolden, Physician to St. Thomas's Hospital, gave the following laudatory evidence: "This has opened a new era, both for man healthy and man diseased;" and a similar one has been added to the Newcastle Infirmary through the interference of Sir John Fife, M.D., who has written a treatise in praise of the bath. That accurate observer, Dr. Thudichum, says: "The public in this matter is far in advance of the medical profession. Our duty as doctors of the healing art simply is, to make ourselves acquainted with the uses of this therapeutic instrument." My friend, Dr. Leared, says:

"An objection commonly urged against the bath is that it debilitates so much, that its use should be only occasional, and confined to the vigorous and robust. But consumption is a disease in which debility is a marked symptom, yet the patients submitted to the bath increased in strength and flesh. This convinces me that the bath cannot be considered as a lowering agent, and that it is likely to prove the best treatment for consumption yet applied."

You will then remember that I am an advocate for the use of the bath by those in health, and, with proper medical advice, in the treatment of a few diseases; and in saying this I express no sympathy with the hydropathic practitioner who introduced them into this country. He has done good, for which I believe he has been repaid pecuniarly by their success, and if he be not insensible to ridicule, he should restrain his pamphleteering friends

from committing the absurdity of comparing his doings to the unselfish and glorious achievements of Harvey, Hunter, and Jenner, as they have done.

The hot-air bath is of very ancient origin, and is a frequent antiquarian relic in this country, especially in the island of Rathlin, where they are constructed like a beehive, with a small opening, and the air inside is heated by a turf fire. They are known as *Tig Allui* or sweating-houses. Hot dry air is, however, very injurious by drying and congesting the membrane of the lungs, throat, and eyes, producing also turgescence of the little vessels of the brain, and liability to hæmorrhage by their rupture. Medicated baths—such as those containing iron, as at Spa; or sulphur, as those of Harrogate—are supposed to act by those agents being absorbed; but all parts of the body, except the palms of the hands and soles of the feet, being rendered impervious by the sebaceous secretion, I doubt the fact. These baths can be easily imitated by the chemist. Time will not allow me to speak of the lamp-bath, or the gaseous-bath, or of such oddities as the mud-bath, or that constituted by the reeking skin of a recently slaughtered animal; but the subject of sea-bathing is so important that I must devote a moment to it.

Sea-water is more stimulating to the skin than fresh water, and reaction is therefore more abundant after it, and its shock, increased by the impulsion of the waves, and chilling effects are soon obviated if such active exercise as swimming be carried on. The fresh and bracing air and exhilarating prospects are much concerned in increasing its beneficial effects. It is a popular fallacy that it is dangerous to take a cold bath while warm by exercise; there is no more suitable time. Soon after the first immersion, which gives rise to breathlessness and even giddiness, a glow, accompained by a buoyancy of the limbs and brave joyous feeling of the mind, succeeds; and so long as they continue, the bather may remain in

the water; but on the first hint of depression, which will succeed, he should leave it, as the worst consequence will follow from the great abstraction of heat and the congestion of the lungs. A short time since one of our lately qualified surgeons was attacked with most severe inflammation of the lungs, owing to such incautious prolonged sea-bathing. Languor, sleepiness, and weariness very often follow from the depression so produced, especially if the redness of the surface, which is so essential, be not attained by friction of the surface with a towel. Dr. Desgenettes, who lived through a service amidst the most pestilential atmospheres of cholera patients in Egypt, and Prof. Padel, who served through the epidemics of cholera and of typhus which had ravaged Florence, attributed their escape mainly to frequent complete ablutions with water mixed with vinegar, and to a daily change of their clothes, which they then fumigated. M. Grimaud regards these precautions as a discovery in the science of prevention, and asserts that one may nearly always guard himself against contagion, and pass his life amongst the sick with impunity during the most terrible epidemics, prevention having now become "*au fond une affaire de toilette et hygiene privée.*"

You will, then, perceive how highly I value baths of every kind, and I must express my deep regret that there is but one institution in Dublin which brings them within the means of the poor and labouring class—I allude to the baths and washhouses connected with the Mendicity Institution, Usher's Island. They have, however, performed their duties as far as possible. About 18,000 is the annual number of bathers, who, for a few pence, obtain every comfort. There were given last year forty-eight baths to the poor gratuitously; but it is much to be deplored that more numerous opportunities for cleanliness among the destitute classes cannot be afforded in this way. In one year the ten baths and washhouses in the city of London, under the 9th & 10th Vict.

cap. 74, gave 1,001,041 baths, and 321,474 women used the washing appliances, the receipts for that year being in the former case £13,369, and in the latter £7,264.

I have frequently asked the poor at hospitals when they had last bathed their whole bodies, and the answer has been "never" or "not for years," except in the case of young men, who occasionally take a plunge into the sea. Among such health is impossible, and epidemics find easy victims. By the way, our law agent at the Health Committee is an advocate for female sanitary sergeants, who shall compulsorily wash the women and children in our humble houses; and if such an interference with the liberty of the subject becomes ever admissible, healthiness will be much promoted. In a ragged school, the rule that every boy should take a warm or tepid bath as he entered, was carried out with the best results—that foul smell which is perceived in any room crowded by the poorer classes was unknown, and contagious diseases were much checked. The change of clothes, and their disinfection by heat for three hours, would be another beneficial step. Washhouses are clearly much to be desired, on account of the pecuniary saving to the poor, but still more because "the washing-day," with its inflictions of dirty suds and damp clothes hung through the room, is detested as much by the artizan as his wealthier neighbour, and tends to change domestic habits to a fondness for the gin-palace.

I feel sure the Corporation, as soon as we have an adequate water supply, will erect baths and washhouses for the poor and labouring classes of our city. Such has been done by municipal authorities elsewhere, and with pecuniary profit as regards the baths. There are many waste plots in the heart of the city which might be devoted to this necessary purpose.

Sir R. Kane, in his recent inaugural address at the Statistical Society, forcibly said:

"I place foremost those means which have for their object to elevate the standard of living, and to increase the vital force—to raise the life energy of the people. 1st. To enable, by cleanliness, the skin to perform those functions by which a proper equilibrium of the solid and liquid constituents of our system and the healthly constitution of our tissues are preserved. 2nd. By a proper supply of air to afford to the lungs the requisite means for aërating the blood, and supporting that combustion of the carbonaceous elements of the food by which the temperature necessary for the existence of animal life is maintained. And 3rd. To obtain full access of light, the true vivifier, the great source of energy in nature, without which neither chemical nor physiological action can be duly carried on. If those beneficent agencies are present, the influence of contagious miasma may be comparatively little dreaded. Those sources of disease of which we are only now beginning to have any real or scientific knowledge, are repelled by the energetic vitality of a healthy frame, and exercise their fatal powers in preference on weakened organizations."

The intelligent authoress of "Simple Questions and Sanitary Facts," who unfortunately leans to hydropathic quackery, remarks:

"But the poor often excuse their dirt on the plea of want of time? This is only the lying cant of dirt and idleness. If they have children, let them employ them to lighten their labours; if they have no family, they have the less to do. A child will be better and more happily employed removing the puddle from before the door, than in making one. Children are quick imitators, and will be sure to copy the habits of their parents. An idle, gossiping mother, lolling against her door, gaping out into the street, will have children like herself, the curse of the neighbourhood they inhabit."

Clothing, as every one knows, is of use in preserving the proper heat of the body, and in preventing the injurious action of sudden changes of temperature upon the skin of man, who is, of all terrestrial animals, the most scantily supplied by natural protectives. The necessity for artificially maintaining the animal temperature is forcibly put by Dr. Evory Kennedy:

"Strange as it may appear, clothes are used equally in cold climates to retain the natural heat, and in warm climates to isolate the body from the surrounding highly elevated atmosphere and burning rays of the tropical sun. The old lady, with her wrap of shawls and fur-lined hood, wending her way to her whist party in

St. Petersburgh, on a December night, has a strange counterpart in the gallant young European officer, mounted on his Arab steed, with his head enveloped in turbaned shaws six inches deep, traversing the plains of Hindostan under a burning sun in the month of June. Yet both are practical philosophers despite the blow-hot blow-cold objection."

Between the layers of clothes there are also strata of air kept at equable temperature, and which but slowly conduct alterations of it from within or without, and as they are confined by the dress above, they do not freely allow of the admission of colder air from below. It is for this reason that in going from a warm room into the cold, we should put on our extra clothing some time previously, so as to heat this protective stratum of air. Linen, which is so great a favourite in temperate climates, is objectionable on account of its high conducting and bad radiating powers, so that it feels cold, and does not freely distribute heat; it is also attractive of moisture, which it retains and thus keeps a damp instead of a dry medium around our skin. The experiment of testing the conducting power of various clothings has been made by covering a metal vessel filled with hot water by each of them, and it was found that while it took 14 minutes to cool when covered with woollen cloth, $12\frac{1}{2}$ sufficed with white flannel, $9\frac{3}{4}$ with cotton, and $7\frac{1}{2}$ with linen. Such reasons have caused the entire substitution of cotton or thin woollens for linen garments in warm climates, and the only objection to them is their rougher surface, which occasionally irritates sensitive skins. Notwithstanding this and other objections occasionally made to woollens—namely, that as their washing is troublesome they are apt to store up dirt, and that they disturb the electric state of the skin when rubbing against it—I really believe that no other medium is fitted for this variable climate to preserve the heat of the body during great cold, or prevent the conduction of intense heat. When linen is put on a perspiring skin the water passes through it, and evaporating still produces cold; flannel, on the

contrary, absorbs the water and gives out heat. Its non-conducting power is clearly useful on the cold winter's day. The wearing of flannel-shirts, or those of merino, which contains about one-third of cotton, during winter or summer, therefore, is now so usual as to realize Boerhaave's maxim, that you should take off your winter clothing at the end of midsummer's day only to put it on the following morning. The only change I would advise would be to wear the flannel inside a linen shirt in winter. to wear it alone in summer, and to constantly use another dress of the same material for night. Woollens unfortunately shrink and spoil gradually in the washing, which operation they frequently require as they absorb so much perspiration. We can perceive that since the very general adoption of flannel inner clothing, the number of deaths in the Registrar-General's report by bronchial complaints is very much lessened. You may have heard John Hunter's receipt for rearing healthy children; it was, "plenty of milk, plenty of sleep, and plenty of flannel." It has been stated on reliable authority that woollen clothing is preventive of malaria in a high degree. Flannel drawers reaching high on the abdomen and a long flannel shirt, so that two layers shall cover that region, are regarded as a capital safeguard against cholera.

Even the colour of dress is not unimportant, as was first demonstrated by Benjamin Franklin. He placed pieces of various coloured cloths on the surface of snow, and found in a given time that the snow under the black was most melted, that under the white the least. Even from this we get hints as to the shades proper for winter and for summer gear; and we are taught the same lesson from the changes of tint which the covering of animals undergo. The primary importance of such functions as perspiration and respiration, which you know the skin possesses, teaches us the necessity for having our garments made of textures permeable to moisture and air;

for this reason the Council of Health of the French army absolutely forbid waterproof clothing; and I never see an india-rubber coat or galosh without being forcibly reminded of Breschet's experiment, which I think I before mentioned to you. He shaved rabbits and coated them with impermeable varnish, and found they perished in an hour or two of cold and suffocation. Waterproof clothing has been prohibited among the London postmen by Dr. W. Lewis, and on the contrary, ventilating gussets introduced in the coat and trousers with the greatest advantage, especially in the prevention of rheumatism. For similar reasons I have often recommended persons who suffer from tender feet to wear the cloth known as pannuscorium instead of leather, especially the enamelled kinds, in their boots. It seems to me that the reason gout attacks the feet so often is, that their natural cutaneous action is impeded, and among the Romans these parts were less often affected than the hands, as the sandals only partly covered them. By the way, it may be very well questioned if these sandals, which allow free perspiration of the foot and render frequent washing needful, are not the most natural form of covering. The Countess de Noailles has lately written an able "apology for bare feet," in which she contended that if the wretched boots the poorer children wear were cast away, the feet and ankles would become stronger, and would be kept cleaner, and there would be much less liability to colds and to illness among girls. Mr. Dowie, a boot-maker, suggested that an india-rubber spring should be placed in the middle of the sole, so as to give the foot its full elasticity, and immediately under the arch of the bones of the foot there is a most admirable natural spring of elastic tissue. Dr. John Brown, the well-known author of "Rab and his Friends, remarks:

"It is amazing the misery the people of civilization endure in and from their shoes. Nobody is ever, as they should be, comfortable at once in them; they hope in the long run, and after much

agony, and when they are nearly done, to make them fit, especially if they can get them once well wet, so that the mighty knob of the big toe may adjust himself and be at ease. For my part, if I were rich, I would advertise for a clean, wholesome man, whose foot was exactly my size, and I would make him wear my shoes till I could put them on, and not know I was in them. Frederick the Great kept an aide-de-camp for this purpose, and, poor fellow! he sometimes wore them too long, and got a kicking for his pains. Why is all this? Why do you see every man's and woman's feet so out of shape? Why are there corns, with their miseries and maledictions? why the virulence and unreachableness of those that are 'soft?' Why do our nails grow in and sometimes have to be torn violently off? All because the makers and users of shoes have not common sense, and common reverence for God and his works enough to study the shape and motions of that wonderful pivot on which we turn and progress. Because Fashion—that demon that I wish I saw dressed in her own crinoline, in bad shoes, a man's old hat, and trailing petticoats, and with her (for she must be a *her*) waist well nipt by a circlet of nails with the points inmost, and any other of the small torments, mischiefs, and absurdities she destroys and makes fools of us with—whom, I say, I wish I saw drummed and hissed, blazing and shrieking, out of the world; because this contemptible slave which domineers over her makers, says the shoe must be elegant, must be so and so, and the beautiful living foot must be crushed into it, and human nature must limp along Princes-street and through life natty and wretched."

I wish the present style of bonnets, more suited in size to an organ-grinder's monkey than to a fine girl, had been the rage when John Brown was writing!

The square-toed boot universal in America, and those with the inner edge straight not curved inwards, are the most natural, as they allow the expansion of the toes—a matter seldom allowed for by our boot-makers, especially as they measure the foot when lifted from the ground. Great comfort is often obtained by having a last carefully shaped for oneself. It is said that the Duke of Wellington, being questioned as to the most essential requisite of a soldier's clothing replied, "A good pair of shoes." What next? "A spare pair of good shoes;" and even thirdly, "A spare pair of soles." One-fourth of the admissions to hospital during the New Zealand war were

from "foot soreness." The shape and weight of all articles of clothing should be such as to allow the freest action of the chest and limbs; and it is allowed that the diminished mortality of our soldiers from heart and lung diseases may be very greatly due to the improvements made of late years in their dress and accoutrements.

Upon the necessity of frequent renewals of inner garments, I need make no remark, save that with our present scanty supply of water, this and other cleanly observances are almost impossible among the poor, unless with the advantages which an extension of the wash-houses I have before alluded to would supply.

In both the extremes of life, when heat-producing power is most feeble, additional warm clothing is clearly demanded, and we seldom now see half-dressed poor children exposed to all weathers under the erroneous notion of making them hardy; and just as hurtful are the carelessly given chilling cold baths, which are occasionally, under the same mistaken notion, inflicted upon children. I have alluded incidentally, while describing the functions of the skin, to various diseases which interference with them promotes, and I previously told you of the influence which bad food had in promoting them; but the remaining subject of diseases of the skin itself being more within the province of curative medicine, I will not here further allude to. There are however few, if any, of them which cannot be shown to depend on the contact of specific matter from without, or the presence of morbid products within, which the skin makes efforts to remove. Cleanliness then, of course, is even more essential than during health.

LECTURE X.

MENTAL AND PHYSICAL EXERCISES—THEIR DISUSE, USE, AND ABUSE.

In all my previous lectures the sources of ill-health against which I had occasion to caution you were such as met with no natural support in our own inclinations; nobody likes bad air, *per se*, nor impure water, nor adulterated food, nor unwashed skins; but there is a powerful principle in man which leads him to neglect wholesome exercise of mind or body—a principle of indolence or love of ease, so constant, so strong, and so obvious in its operation, that political economists have been led to assume it, in conjunction with the love of gain and of pleasure, as the three great mainsprings of human conduct. There is, no doubt, a natural pleasure attached to exercise, mental or bodily, but it is only discovered as a result, and is not the initiatory cause of exercise. We experience the benefits in some particular case of labor, and then sometimes work systematically with a view to these benefits. But that it is often a strain upon our natural inclinations is proved by the facility with which we relapse into idleness, and the pain and difficulty with which those habits are re-acquired is indicated in the aphorism "*dolce far niente*," which has its analogue in every language. The only exception to this statement is the restlessness or love of exercise which seems natural to children in their sports and gambols, and which seems either a temporary provision of Nature, ceasing when reason asserts its sway, or one which a vicious or neglected physical education suppresses in adult life. There is no more fatal opponent of the health of any organ than its

disuse, for it leads to its decay or extinction, by conversion generally into what would seem the vilest of our components—fat. The removal of the womb when its functions are over, or of muscles when unexercised, are examples of this degeneration. The Author of our being has indeed placed many of our organs beyond our power to injure them; thus we must use our lungs—any attempt to refrain from so doing being attended with most unpleasant and suffocating sensations; and even any inattention to the act of breathing, which leads to an insufficient supply of air, is compensated for by a sigh. The onward movements of the bowels and the action of the heart must, to a certain extent, go on independent of our will, and it is interesting to remark that they are supplied by a separate nervous system from that which controls our voluntary acts; but many other organs are left to our own care, and in the long-run a neglect of these leads inevitably to the ruin of all. So unfavorable to longevity is mental or physical idleness that it may be asserted no great idler ever attains old age.

The benefits of exercise may be perhaps considered as a subject belonging rather to the lecturer on physiology than to a lecturer on public health; but there are some points to be observed respecting exercise which commonly escape notice, and which I am doubly anxious to insist on because of their connexion with sanitary provisions. One of these is, that exercise to be most profitable ought to be as far as possible not systematic, and taken for its own sake, but spontaneous, and incidental to some occasion of either business or amusement. So intimate is the connexion between mind and body, that it is difficult to benefit the latter unless while relieving and pleasantly occupying the former. A man who takes the same walk every day, and meets the same people, does not derive half the benefit from it that he would from the same amount of exercise amid new and interesting scenes. In fact, his mind not being occupied along

with his body naturally reverts to the thoughts which engross him in the counting-house or the study, and thus the intellectual part of his nature derives no relaxation, and the body suffers as a consequence. A hard-reading friend of my own was daily in the habit of walking a regular number of times round the College-park, but that he derived no benefit from this monotonous routine was evident from his morose and melancholy expression all the while. This mental condition is the secret of the marvellous efficacy of a Connemara, Highland, or Swiss tour, to the jaded lawyer, merchant, or student. Even if by a violent effort he banishes his business from his thoughts and fastens them on the exercise itself, he derives but little advantage; the exercise becomes a toil, and the most depressing of all toils, because it is unaccompanied by a sense of that which sweetens all labour—the sense of progress and useful work done. I have heard that that benevolent nobleman, Lord Rosse, during the famine years, anxious to relieve distress, and equally anxious not to encourage habits of pauperism, paid men so much a day for digging holes in his demesne, and paid them again for the filling of them up. The laborers are said to have manifested the most extreme disgust at the occupation, although the work was not harder than most useful labors. It is this sense of the inutility of the work done by the labor in some of the military prisons which constitutes much of the severity of the punishment. And this remark is as true of mental exercise as of bodily. Who can bear to sit down to a hard mental operation, the learning of a new language suppose, or the acquisition of a science, merely for the sake of sharpening his intellectual faculties. We must be animated with the hope that when we have learned the language or mastered the science, we shall be possessed of somewhat of value which we had not before, and that we shall be more richly furnished for the enjoyment and appreciation of the system

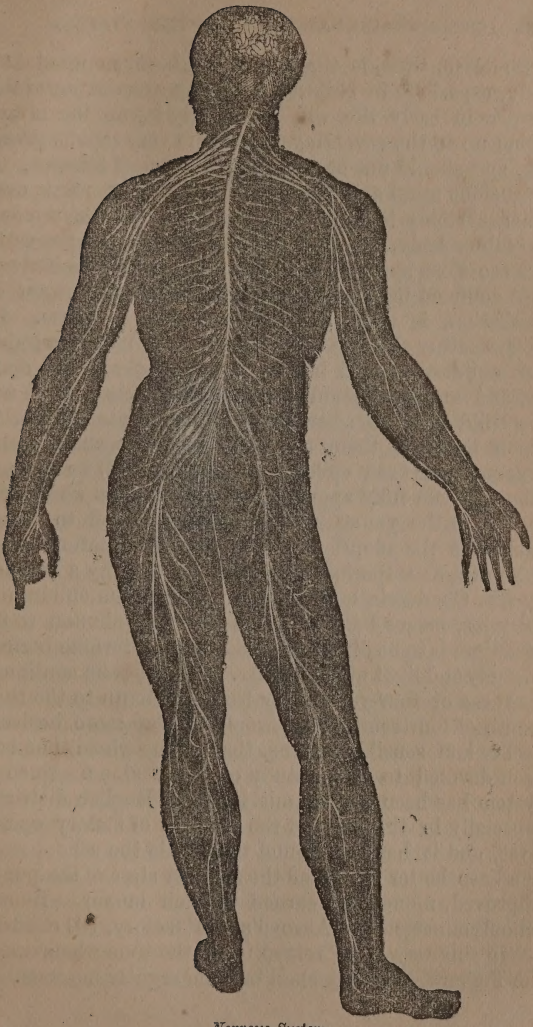
of things around us, or else the labor will be intolerably dry and repulsive, and will fail to afford even that discipline which we seek, for all good discipline involves an element of pleasure. The kind of intellectual exercise which is most beneficially stimulating is that in which the mind is not merely receptive, but partly, at least, creative; for instance, in studying any work, if we merely receive the author's statements, feelings of lassitude will much sooner supervene than if we make efforts to judge, methodize, or investigate. The wholesome effects of original mental work are not confined to the intellectual powers alone, but extend to the nutritive and other corporeal functions. Of course, excess of this or any other labor is hurtful, and in the case of original work is peculiarly exhausting. Some of these principles are illustrated in the following extract from my favourite book, "The Autocrat of the Breakfast-table:"

"This business of conversation is a very serious matter. There are men that it weakens one to talk with an hour more than a day's fasting would do. Mark this that I am going to say, for it is as good as a working professional man's advice, and costs you nothing: It is better to lose a pint of blood from your veins than to have a nerve tapped. Nobody measures your nervous force as it runs away, nor bandages your brain and marrow after the operation. The men of genius that I fancy most have erectile heads like the cobra-di-capello. You remember what they tell of William Pinkney, the great pleader; how in his eloquent paroxysms the veins of his neck would swell, and his face flush, and his eyes glitter, until he seemed on the verge of apoplexy. The hydraulic arrangements for supplying the brain with blood are only second in importance to its own organisation. The bulbous-headed fellows, that steam well when they are at work, are the men that draw big audiences and give us marrowy books and pictures. It is a good sign to have one's feet grow cold when he is writing. A great writer and speaker once told me that he often wrote with his feet in hot water; but for this *all* his blood would have run into his head, as the mercury sometimes withdraws into the ball of a thermometer."

Another observation is, that as each kind of business and employment exercises a particular set of organs of

the body or faculties of the mind, so our amusements ought to be so contrived as to afford rest to those sufficiently worked organs or faculties, and call into play those others which ordinarily lie dormant. Nature herself does this for us in some remarkable instances; if the eye has been continuously looking at any particular bright colour, and is then transferred to a black surface, the complementary colour of the same figure appears to be delineated on that surface—a spontaneous effort of the organ to restore the balance of its powers. To apply this to recreations and exercise. To many, whose ordinary business is of an active kind, involving no intellectual operations, except routine or clerk-like ones, yet whose mental powers are superior, chess is a most suitable relaxation. Billiards, on the other hand, is found to be a better game for those who have much head-work and not enough of exercise. Poetry, history, or philosophy, are the natural reliefs to a mind which has to plod through dry statistics or legal arguments. The last remark I wish to make on this subject is as to the nature of the stimulus. There is a healthy stimulus which puts the whole mind and body into tone, and an unhealthy one, which is followed by depression, and puts the whole mind and body out of tone. Gambling, for instance, excites the mind, or rather the passions, and in such manner (not unlike dram-drinking) that each impulse leaves a craving for a still stronger impulse. The brain is in direct communication with every part of the system by the spinal cord and the numerous nerves which pass from it, and the largest of these wonderful conductors are shown in the diagram on opposite page.

There is also a second nervous system called the sympathetic, the functions and diseased states of which are still very obscure; but it is certain that the brain and spinal cord and this other system have reciprocal controlling power.



Nervous System.

So close, then, is the connexion between mind and body, especially in children, that any over-taxing of the former in early life will irreparably injure the latter, which up to the seventh year or so is very rapidly growing, and should not be wasted by the act of thought. A precocious mind and preponderance of the nervous over other systems is often the accompaniment of a puny scrofulous body, and both are the results of a too early and too close application of the mind, while the body is kept confined in the school-room, which, from want of ventilation, is often a direct excitant of disease. In mild weather I have often thought it most desirable that children should be taught their tasks in the open air, and amid the beauteous natural objects around us. If a child survives after the ill-timed mental forcing to which many of them are subjected, hypochondriasis, dyspepsia, or even epilepsy or hysteria, will be its burthen. I can fully appreciate the advantages which will accrue to the young of this generation and to future ones from the adoption of that plan of education which is known as "the half-time system," chiefly advocated by Mr. Chadwick, and which, applied to the children of the poor, means half the usual time now allotted to instruction, is to be divided between short alternate periods of study and light manual labor. This system continued for three or four years—say from the tenth to the thirteenth or fourteenth year—would rear up more healthy, docile, and sensible youths, than if the whole time had been devoted to either study or labor alone. Such a system has been carried out in many English districts, especially in the case of the children of factory operatives, and it has been found that while the school work has been better done, and the sanitary state of the pupils improved, money was earned by their labour. In one school connected with Akroyd's great factory, 761 children are in this way being reared up to the time when, under the Factory Act, they shall become regular laborers.

So far from civilization being in itself repressive of the perfect development of the human body, its continuance in health, and the prolongation of its existence, as has been asserted, I feel sure that its influences are in the contrary direction. The uncultivated savage rarely attains to old age; physical life-shortening influences from without, such as changes of temperature, hunger, or accident, and such exhausting ills as unrestrained passions from within, exert their full power over him who is unblessed with the many resources which education and art have given to cultivated society. It is acknowledged by all military authorities, that officers reared in the lap of luxury have not shown themselves to be inferior to those whose lot cast them into "slower" places. The wealthy who are slothful and unintellectual, are however, short-lived and habitual invalids; but that the aristocracy have less chance of life than their humble fellow-countrymen, is a surprising statement, and one which would not gain credence if it came from a less eminent statist than Dr. Guy. He says: "Luxury, too, like intemperance, tends to undermine health, and shorten life. Hence, the higher orders are short-lived, and we may therefore safely infer unhealthy while they live. Our agricultural labourers, in spite of the many disadvantages to which they are exposed, are much longer-lived than any of the higher classes, and the aristocracy are nearly on a par with the members of benefit societies in Liverpool, the unhealthiest city in England. Of the classes, too, which enjoy the most ample means of self-indulgence, those are the most unhealthy, which possess those means to the greatest extent. Thus, the gentry are more healthy than the aristocracy, the aristocracy more than the members of royal houses, and these last more healthy than crowned heads. Those who occupy the highest places in the social scale are probably, in point of health and longevity, but little raised above the very meanest of their subjects."

With regard to the time for mental exercise, there is no period when the acquiring or reflecting powers are so active as in the early morning, and study can therefore be indulged in most profitably. The silence, the cool refreshing air and brightness of the morning, have a most effectual calming effect on the mind. The most successful and healthful students I have known were morning-workers. In Dublin I am sure that later hours at night and laziness in the morning are more habitual than in most other capitals. As examples of the evils of excessive mental labour, I shall briefly allude to those diseases which affect men whose brain is overworked. The fact that there are such is becoming every day more apparent; yet the danger to be apprehended in this respect is not fully realized, although it is a matter of national importance because of the eminence of the victims of such errors. The exercise or disuse of our brains is, however, not at all a voluntary matter, or as the American philosopher I quoted a little while ago puts it:

"Our brains are seventy-year clocks. The Angel of Life winds them up once for all, then closes the case, and gives the key into the hand of the Angel of the Resurrection. Tic-tac! tic-tac! go the wheels of thought; our will cannot stop them, they cannot stop themselves; sleep cannot still them; madness only makes them go faster; death alone can break into the case, and, seizing the ever-swinging pendulum, which we call the heart, silences at last the clicking of the terrible escapement we have carried so long beneath our wrinkled foreheads."

Mere muscular work seems rarely to be injurious, for the recuperative power of that system seems illimitable, and nought but increase of its powers supervenes; but from excessive brain-work fatal and prolonged diseases arise, and its victims are thus made to pay the forfeit of their ambition. Men of intense and original thought, whether centred upon letters or commercial speculations, men ambitious of power, are those whom we lose in this way, for their brains have not merely to work for their

own bodies only, but perhaps to guide a hundred other brains or human machines, through whom their great schemes are carried out. Dr. Richardson, whose great literary and practical services in medicine have gained him the gratitude of mankind, in speaking of this error of intellectual men, into which it must be hoped he himself does not fall, adopts the following appropriate simile:

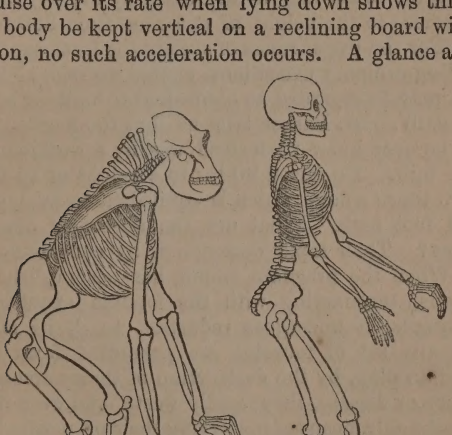
"An electric battery works a single wire from the city to Brighton, and does its work well, and goes on for some months before it is dead or worn out. Can it do the work of a hundred wires? Oh! yes it can; but it must have more acid, must wear faster, and will ultimately die sooner. We may protect the plates, make the battery to an extent self-regenerative, as the body is; but in the main the waste is in excess of the supply, and the wear is as certain as the day."

Men with over-worked brains suffer very similar consequences, and induce such fatal diseases as aggravated dyspepsia (attended with great loss of that remarkable element of brain composition, phosphorus), paralysis, apoplexy, softening of the brain, insanity, or premature old age. They also suffer from ordinary ills more severely, so that they can bear no pain or depressing curative measures, and often acquire a morbid sensibility which converts activity into irritability, and seclusion produces nought but moroseness. Self-dislike follows, and suicide—that lamentable blot on the civilization of the nineteenth century—too often ends this train of preventible misfortunes. The painfully interesting examples of Hugh Miller, Prof. M'Cullagh, and Admiral Fitzroy occur to me in illustration. But even the diseases to which the frame succumbs prematurely from mental over-work must be regarded as constituting a kind of "chronic suicide," the sacredness of the body and its claims for support from its in-dwelling master, the mind, not being fitly recognized. An eloquent President of the Public Health Section of the Social Science Association declared: "When people say we should think more of the soul and less of the body, my answer is,

that the same God who made the soul made the body also. It is an inferior work, perhaps, but nevertheless it is His work, and it must be treated and cared for according to the end for which it was formed—fitness for His service."

The physiological system which is most readily and fully influenced by exercise is the circulation. The contraction of the muscles is due to chemical change of their substance, which the blood feeds with oxygen and with reparative material, and moreover withdraws the waste matter the result of the muscular action. Thus, is created a necessity for an additional supply of blood. The pressure of the muscles upon the deeper veins is their chief means of circulation, for they are not freely provided with valves, as those near the surface are. This muscular activity gives rise to greater action in the digestive and blood-making organs, and likewise in the lungs, liver, kidneys, and skin, by which the waste matter is thrown off, and those organs which may have been lying partially dormant are stimulated into healthful vigour. Exercise promotes the breathing process especially, ridding the blood of a greater quantity of carbonic acid, as is shown by the respective amounts breathed during the following exercises:—If 480 cubic inches represent the quantity inspired per minute during complete rest, 7 times as much, or 3,360 cubic inches will be taken in by a person running at the rate of 6 miles an hour, 5 if walking 4 miles an hour, and 4 times if trotting a horse. The giving off of carbonic acid is proportionally increased, and an increased amount of food to supply this waste must be provided, and above all the freest flow of pure air is evidently necessary. Exercise also urges that neglected, though much talked-of organ, the liver, to remove biliary matters from the blood, and the want of it is readily apparent in the sallow skin, dulled brain, and turbid bowels of the lethargic; and lastly, the skin is brought into healthful play, for its tem-

perature is increased, its secreting function exalted, and its breathing process is encouraged by the fresh, ever-changing air. Flannel is a most necessary clothing during exercise, and great cleanliness must be observed. Water may be drank in moderation to make up for the loss the waste of muscle discharges through the skin. Heated skin, quickened heart, and rapid breathing are also produced by fever; but in this case these effects are due to excessive waste without corresponding reparation. I may mention that in standing several muscles are exercised to preserve the posture, and the quickening of the pulse over its rate when lying down shows this, for if the body be kept vertical on a reclining board without exertion, no such acceleration occurs. A glance at this



Gorilla. *Man.*

view of man's skeleton will show you that considerable muscular force is expended in maintaining the vertical

position. For the sake of comparison the skeleton of the most manlike ape is figured alongside.

The muscular system is of all the apparatus of animal life perhaps the most important; most of our daily acts and avocations are performed through its agencies, and the noblest bursts of eloquence or sublimest thoughts could not be communicated for the improvement or enlightenment of man without its aid. Will we, then, not exercise and perfect this great endowment? The Rev. Prof. Haughton, who is pre-eminent as a physiologist, has calculated that the labouring man daily uses his muscles to a degree which may be expressed by saying, that he would raise to the height of one foot from 250 to 350 tons. For the upper ranks of society the force expended, including ordinary avocations, should average 150 tons, which may be regarded as equivalent to walking some 9 miles daily. Dr. Parkes tells us that the hardest day's work he ever knew performed was by a workman in a copper mill. He raised 90 lbs to a height of 18 inches 12,000 times a day, which is equivalent to raising 723 tons 1 foot high. What are the effects of disuse of muscles? Their rapid destruction by conversion into fat. When the pregnant womb has accomplished its functions, terminating with the forcible expulsion of its contents, it undergoes reduction to $\frac{1}{24}$ its size.—When any set of muscles are prevented from being called into play, by the destruction of their nerve owing to injury or disease, they rapidly waste, and even disappear—the only means of preserving their properties being to supply, in place of the will, that wonderful and still mysterious agent, electricity. Hysterical girls have been known to lie down and remain for months without any motion, believing that they suffered from spinal disease, and they have occasionally paid the severe penalty of utterly wasted muscles or stiffened joints. A somewhat appropriate cure would be to persuade them that the suitable adviser in their case resided in some distant and

inaccessible place, and the exercise in travelling to it would probably remove the hallucination which prevented them from relying on their muscles.

Another interesting example of the removal of an organ if long disused, perhaps in successive generations, is afforded in all the blind animals found in the mammoth caves of Kentucky; and it would be interesting to find whether eyes would be restored to them, if for two or three generations some of them were transferred to the light. On the other hand, of all tissues the muscular is the most susceptible of increase, or hypertrophy, as we call it, by augmented exercise—witness the blacksmith's arm or the opera-dancer's leg. It is for this reason that excessive exercise proves injurious by enlarging the heart, which may be followed by suddenly fatal effects. Too great or too constant use of one set of muscles is also likely to attract disease to them, such as the development of tumours, the materials of which circulate in the blood. The dancing epidemic of the 14th century was a curious instance of hallucination spreading over vast populations; so excessive were the exertions of those who were afflicted with it, that they often died from sheer exhaustion.

Concentration of bodily or mental efforts on one object for a length of time is always injurious, as extreme exhaustion of the strained organs will follow; but the ill effects will afterwards react upon others, and the only mode of attaining anything like perfect exercise is to engage all the mental faculties and groups of muscles in performing it. The proper kind and amount of bodily exercise is so variable with the circumstances of each, that general rules are with difficulty laid down, but the following seem to me judicious:—1. During ordinary health, some part of each day should be spent out of doors, even in weather apparently unsuitable, for clothing supplies a means of obviating all ill effects. 2. It should be as active and general as possible, and carried

to the point of slight fatigue. 3. It should be taken at the best time of the day, which I consider the morning, with the precaution of taking some food, such as a cup of milk or coffee and a biscuit before going out, a substantial breakfast being taken afterwards; or if this meal be taken early, exercise may be commenced an hour or so afterwards. The celebrated physician Doumoulin having being surrounded at his last moments by several of the most distinguished doctors in Paris, who vied with each other in expressions of regret at his situation, thus addressed them: "Gentlemen, do not regret me; I leave behind me three of the greatest physicians." On their pressing him to name them, each anxiously anticipating that his own name would be amongst the number, he briefly added: "Water, Exercise, and Diet," to the no small discomfiture of his disappointed brethren. Among methods of exercise, it is believed that horse exercise, if attainable, is superior to all others. Such manly vigour is in this way acquired that Frederick the Great is reported to have said: "When I consider the physical structure of man, it appears to me that Nature had formed us rather to be postilions than sedentary men of letters." The greater variety of scenery it brings before the mind, the agreeable way in which the attention is fixed upon guiding the movements of the horse, and the rapidity of motion it confers without fatigue, make it most desirable. Prof. O. W. Holmes thus puts it:

"Saddle-leather is in some respects even preferable to sole-leather. The principal objection to it is of a financial character. But you may be sure that Bacon and Sydenham did not recommend it for nothing. One's *hepar*, or, in vulgar language, liver—a ponderous organ, weighing some three or four pounds—goes up and down like the dash of a churn, in the midst of the other vital arrangements, at every step of a trotting horse. The brains also are shaken up like coppers in a money-box. Riding is good for those that are born with a silver-mounted bridle in their hand, and can ride as much and as often as they like, without thinking all the time they hear that steady grinding sound as the horse's jaws triturate with calm lateral movement of the bank-bills and promises

to pay, upon which it is notorious that the profligate animal in question feeds day and night. In riding, I have the additional pleasure of governing another will, and my muscles extend to the tips of the animal's ears and to his four hoofs, instead of stopping at my hands and feet. Now, in this extension of my volition and my physical frame into another animal, my tyrannical instincts and my desire for heroic strength are at once gratified. When the horse ceases to have a will of his own and his muscles require no special attention on your part, then you may live on horseback as Wesley did, and write sermons or take naps, as you like."

Of boat exercise he says:

"You can row easily and gently all day, and you can row yourself blind and black in the face in ten minutes, just as you like. It has been long agreed that there is no way in which a man can accomplish so much labour with his muscles as in rowing. It is in the boat, then, that man finds the largest extension of this volitional and muscular existence; and yet he may tax both of them so slightly, in that most delicious of exercises, that he shall mentally write his sermon, or his poem, or recall the remarks he has made in company, and put them in a form for the public, as well as in his easy-chair."

Dr. Combe truthfully said:

"Dancing is a cheerful and useful exercise, but has the disadvantage of being used within doors, in confined air, and often in dusty rooms and at most unseasonable hours. Practised in the open air, and in the day time, as is common in France, dancing is certainly an invigorating pastime; but in heated rooms and at late hours it is the reverse, as these do more harm than can be compensated by the healthful exercise of the dance."

So important are gymnastic exercises and games of agility or strength, and so necessary to preserve the vigour and manly development of our youth, that the hygienist must look with great satisfaction on the extension of cricket as an ordinary game in this country; while the volunteer movement—which, it appears, must be in Ireland, on account of our reputed pugnacity and the attractions we seem to offer to agitators and boasted invaders, denied us—has done a vast deal to augment the robust health of the English nation by the regular and systematic exercise in the open air which it entails. The emulation it gives rise to supplies that mental

stimulus which I have argued should be associated with every kind of bodily exercise. We learn also much hygiene from the rules of the pugilist or pedestrian when training, whose motto is "Work and Diet." He rises early after sleeping on a hard bed, takes a small quantity of food—for example, an egg—and takes a moderate walk for an hour, when he bathes and breakfasts afterwards. This meal consists mainly of underdone meat, with perhaps tea—butter, sugar, and much milk being excluded. Half-an-hour after breakfast he begins his hard walk of ten or twelve miles, after which he is rubbed down, and takes a cold bath. His dinner consists of bread, meat, and a small quantity of vegetables. A little tea is taken instead of supper, and the day is wound up with a short walk just before retiring to rest. This brings them into a perfect state of health, which would render them the most long-lived of our kind, save for the course of dissipation which usually follows the contest. Even in the hottest parts of India bodily exercise is necessary, and the much greater prevalence of disease among the privates than among the officers of our regiments there, has been hitherto due in a great degree to want of suitable exercise. Of all means of exercising none is more beneficial than the use of the gymnasium. In it time is economized, the companionship and rivalry are encouraging, and it is moreover available during the short or wet days of winter.

For reasons before stated there should be the freest ventilation in such a building, else it will never approach the usefulness of open-air exercise. In our army all gymnastic exercises are encouraged, and in the French service there is very sensibly added swimming and singing, which latter improves the power of the lungs and affords recreation. Reading aloud for similar reasons is very advisable. A few weeks' gymnastic practice at Aldershot increased on an average the men's chests $1\frac{3}{8}$ inches, and the arm $\frac{3}{4}$ of an inch. The establish-

ment of a good gymnasium seems to me one of the best projects which the directors of the Winter Palace might undertake; and I am sure thousands of those who are so closely occupied as to render concentrated exercise the only kind possible, would take advantage of it.

With respect to railway travelling, which may be considered as a method of exercise, a few remarks seem necessary. You may be perhaps aware that the *Lancet*—that vigorous paper which we have to thank for much sanitary reform in the way of exposure of adulteration, and otherwise—undertook to investigate this question a year or two ago. Evidence as to the liability to taking cold was given by Dr. Williams, and he traced many cases of sore throat, earache, and toothache, pleurisy, rheumatism, and sciatica, to this cause, for which the remedy is simple—warm clothing and proper ventilation without draught, especially by the roof of the carriages. Dr. Angus Smith has proved that without means for airing, a "crowded railway carriage while going at the rate of thirty miles an hour, is as unwholesome as the strong smell of a sewer, or as a back yard in one of the most unhealthy courts of one of the most unhealthy streets in Manchester." Dr. Forbes Winslow detailed most graphically the mental and physical fatiguing effects which result from the anxiety to catch the train, hurried breakfast, too rapid efforts to be in time, &c.; and lastly Mr. White Cooper, the eminent oculist, avers that much injury to the sight results from the efforts to follow the ever-moving print, which, in railway literature, is not of the best. So that I think a fair case has been made out against too constant railway travelling; and as much less oxygen is inhaled or carbonic acid exhaled by such passive exercise than by walking or riding, its evil effects should be compensated for by freer exercise, or it will be necessary to set it down as one of the unsanitary influences which may degenerate the race in this nineteenth century.

The provisions that may be made for the exercise and recreation of the public are various; but foremost among them stands the institution of public parks, gardens, and walks, ornamental in appearance, healthy in situation, well drained, and easily accessible to the working classes. In every respect, save the last, our Phœnix Park is unrivalled; but its great distance from the heart of the city limits its utility to those who have much idle time on hands, or else to those who can have horses and carriages at command. Excepting on general holidays, the Park is but sparingly resorted to by the humbler classes. How to remedy this is a problem worthy of our best attention. Perhaps the penny omnibus running on rails, and capable of holding fifty passengers, for which a company has just got permission to lay the lines, will be found to pay; but if not, I see no reason why it should not be partly aided by the authorities, as is the case with the two-sou omnibuses running to all the parks about Paris. If the line of quays be found too narrow for such a tramway, why not devise a new approach; and if the day ever comes when we will have our river's sides further embanked, as they are now doing with the Thames, we will have room to spare along the quays; or by the narrowing of the river, the water might become deep enough to allow such small steamers with jointed chimneys as ply from bridge to bridge in London, to be adopted by us. Chemistry demonstrates the usefulness of trees and other plants in a city, for besides removing the poisonous carbonic acid and restoring oxygen to the air, for which they are the only agents in nature, they throw out so much moisture that the ill effects of numerous fires and a concentrated population in heating and drying the air of cities is thereby obviated. A single cabbage plant was found to exhale 19 ounces of water in the 24 hours. Your aquarium most clearly shows the compensating and mutually preserving effects of plants and animals. The refreshing

influence of a garden or green space on the spirits and health of infirm persons and children cannot be doubted. The provisions of the Public Health Act, 1848, concerning pleasure-grounds seem more useful and generally applicable than those of any act bearing on Irish towns; and with regard to pleasure-grounds for the lower classes, no town can be worse provided than Dublin. In some of the poorer parts, accustomed to no play-ground save the noisome alley, the children present none of the features of childhood. Many spaces from which houses have been removed might be cultivated, or even paved, and appropriated for such purposes, and I can see no objection to opening and planting disused graveyards (as for instance St. Mary's) for public walks, as has been done in other cities.

In many of the dilapidated parts of the Liberty, and even in close proximity to our national Cathedral, there are now open spaces which, if converted into "spirit-raising and blood-purifying gardens" for the recreation of the people, would recompense their owners, and do much to raise our poor from the social degradation under which they surely suffer.

During the summer and autumn months, resort to the seaside, if it were only for a few hours, is a great boon to the over-worked and ill-lodged artizan, and to his too often ill-fed and sickly family. Railways have made the sea, and the beauteous hills of Bray, Killiney, and Howth, most accessible; but they have, at the same time, made these neighbourhoods so commercially valuable that property has laid its iron hand upon every bit of rock, sand, and shingle, on every breezy hill and every pleasant common near this metropolis, and forbidden the poor man the purest and best of pleasures, the health and refreshment afforded by the face of Nature. As to field-walks, they are gone from us long ago. In England, there is nothing of which the people are more tenacious, and they have preserved them in plenty. Our

humbler fellow-citizens have been, by one means or another, year after year—I will not say robbed of, but certainly ousted from, every field-walk in the neighbourhood of Dublin, and the roads lie between stone walls, which cannot be overlooked save when on horseback; so that the mental concomitant, which I have maintained is necessary to give value to exercise, is lost. There should be an organized movement to restore some of our field-walks, whether by purchase, litigation, or the pressure of public opinion. A few years ago, Prof. Jukes, who, with other Englishmen visiting our land, was astonished at the selfishness with which such places are kept private, put himself at the head of a committee for the opening of the passes round Bray Head.

On this subject I may be excused for quoting the words of one of Scotland's most gifted writers, once a journeyman mason. Speaking of a very dismal period of his life, Hugh Miller says:

"I threw myself, as usual, for the compensatory pleasures on my evening walks, but found in the enclosed state of the district, and the fence of a rigorously administered trespass law, serious drawbacks, and ceased to wonder that a thoroughly cultivated country is, in most instances, so much less loved by its people than a wild and open one. Rights of proprietorship may exist equally in both; but there is an important sense in which the open country belongs to the proprietors and to the people too. All that the heart and the intellect can derive from it may be alike free to peasant and aristocrat; whereas the cultivated and strictly fenced country belongs usually in every sense to only the proprietor, and as it is a much simpler and more obvious matter to love one's country as a scene of hills, and streams, and green fields, amid which Nature has often been engaged, than as a definite locality in which certain laws and constitutional privileges exist, it is rather to be regretted than wondered at that there should be often less true patriotism in a country of just institutions and laws, whose soil has been so exclusively appropriated as to leave only the dusty high-roads to its people, than in wild open countries in which the popular mind and affections are left free to embrace the soil, but whose institutions are partial and defective."

Alluding to the same district, John Stuart Mill says:

"For instance, the exclusive right to the land for purposes of cultivation does not imply an exclusive right to it for purposes of access, and no such right ought to be recognized, except to the extent necessary to protect the produce against damage and the owner's privacy against invasion. The pretension of two Dukes to shut up a part of the Highlands, and exclude the rest of mankind from many square miles of mountain scenery, to prevent disturbance from wild animals, is an abuse; it exceeds the legitimate bounds of the rights of landed property."

It is gratifying to record that many of our great landed proprietors, whose demesnes are favourite resorts, the Duke of Leinster, Marquis of Conyngham, Mr. Lambart, Earl of Howth, and others, have acted in a more generous spirit.

It may not be an inappropriate conclusion to this lecture if I express my conviction that the efforts which are being made to train females for various industrial employments will be productive of increasing bodily and mental health, while they will be also fraught with social advantages. The objection that employments interfere with the fulfilment of the domestic duties may be answered by the fact, that there is a large proportion of our female population who are not so fortunate as to be called to such positions.

The successes of one establishment are well illustrated in a recent paper by Prof. Houston:

"During the first three years of the existence of the Queen's Institute, 607 pupils have been trained in it, and about 350 of these *are known* to have found employment, and considering the novelty and difficulty of the experiment, the fact establishes two or three important conclusions. First, that there is a very large number of educated women sorely in need of remunerative employment. Secondly, they prove that women of this class are capable of acquiring any ordinary mechanical art equally well with men, provided they have the time and will bestow the pains necessary for its acquisition. The difficulties under which the Institute has laboured in its efforts to train its pupils have been so great, that its success cannot be measured at all by the number of finished workwomen it has turned out. To have succeeded even in the smallest degree is very strong evidence of the soundness of the

principle on which it is based. The reports constantly dwell upon the fact that the Institute has been dealing with women of mature years, whose education has in most cases been lamentably defective; who have had no training in habits of business; whose fingers have lost the pliancy that belongs to youth; whose minds are drawn off from the art they are endeavouring to master by the cares of the present hour; who can at the utmost snatch but a short time from the pressing business of the day to attend the class in which they are instructed; and who are obliged to accept the first situation that presents itself, whether they are perfect in their trade or not. If in the face of these difficulties three or four hundred women have been even moderately qualified for their respective walks in life, may we not safely conclude that if women were educated with the same care as boys, and were early trained in habits of business, and in the practice of some special art, they would exhibit not less skill than men?"

The question is very different, however, with regard to factory hands, and Dr. Bridges of Bradford describes as follows the ill effects of their labour:

"I am guilty rather of diminution than exaggeration of the truth in saying that to stand ten hours is a muscular exertion for which a very large number of women are permanently unfit, for which *all* women who are about to be mothers are unfit without exception. What is true of the mother and her child before birth is also true afterwards, and with many additional reasons, moral as well as physical. The mother is the only fit nurse of the infant, is its only proper educator. For a mother to go into a factory, trusting her baby to a paid nurse, whose only care is to hush its cry and lull its irritable brain with opiates, is an act of infanticide in which it is not the mother that I blame alone or most."

Notwithstanding the abject distress of the operatives in Lancashire in 1862, the death-rate was extremely low, owing to the greater care which the mothers were able to bestow on their offspring when they were thrown out of employment.

On the agricultural employment of women the same results follow, as the medical officer of the English Privy Council relates:

"The mother, as soon as she can rise from her confinement, goes again to work, leaving, while she is away, her infant to anyone who will pretend to take care of it. Instead of its natural food, en-

tirely improper stuff is given it. Cow's milk is dear and often quite unattainable by these people, and sugar sop—a lumpy mass of bread, water, and sugar—is given instead. This is either given cold, or is left on the fire-hob in a cup, seldom or never changed or cleaned, whence the fermented and sooty mass is heaped into the infant's mouth by the nurse, who prefers this mess to cow's milk, under the notion that 'the two milks could never agree.' But this is not the worst. 'So-and-so has another baby—you'll see it won't live,' is the neighbourly view taken among these demoralized populations. And the predicted event soon comes—perhaps through the normal operation of the diet—perhaps through the almost incredible cruelty of deliberate starvation—perhaps through an intentional or unintentional over-dose of the opium which is universally employed. A medical man is called to the wasting infant, 'because there is so much bother with registering.' The mother says the child is dying, and won't touch food. When *he* offers food, the child is ravenous, and 'fit to tear the spoon to pieces.' Where the coroners have been induced to support attempts to save life; where inquiry has been made, and severe admonition, with an appearance of a chance of committal; also, where the registrar has pretended to refuse registration without medical certificate in families notorious for their loss of infants—in these cases an amendment has taken place. Bad as is the starvation of infants, another practice is more common and more lethal; this is the drugging with opium. Occasionally they are the subject of inquests; sometimes they are recorded as cases of 'overlying;' but by far the most common end is the simple registration and burial as cases of '*Debility from birth—no medical attendant*,' '*Premature birth, &c.*'"

In the town of Spalding, Lincolnshire, 297 lbs. of opium were sold in one year, or 127 grains for each inhabitant of the district.

LECTURE XI.

SANITARY ARCHITECTURE—HOSPITALS.

After Medicine, the professions most concerned in the preservation of the public health rank those of the architect and engineer, and that they have been alive to this responsibility is evident from the constant attention which the subject has received in the columns of their influential organ, the *Builder*, and its younger sister, the *Dublin Builder*. When speaking of ventilation, water supply, baths, and public parks, and the approaches to them, I had occasion incidentally to trespass upon the domains of these most useful professions in laying down the principles upon which these sources of health depend, and I shall now endeavour to apply their teachings to the case of hospitals, lodging houses, and the dwellings of the poor, and afterwards bring before you a few facts connected with sewerage, and proposals for the utilization of refuse.

Hospitals have existed for fifteen centuries, and have been regarded as institutions where every aid which science or benovolence can command, should be brought to bear on the care of the sick. It seems, therefore, almost ridiculous to insist that they shall at least do the sick no harm; but it was once necessary, for in the older civil hospitals the mortality was very much greater in them than among patients suffering from the same diseases out of them; and as regards military hospitals, Sir John Pringle, in 1764, was stating an undeniable fact when he asserted that "hospitals are among the chief causes of mortality in armies, on account of the bad air and other inconveniences attending them." The only ones which he found at all wholesome were those that had broken windows and other dilapidations. They were,

again, called "dismal prisons, where the sick are shut up from the rest of mankind, to perish by mutual contagion;" and Pouteau also, at about the same period, asks, "Des hôpitaux servient ils donc plus pernicieux qu' utile à l'humanité?" The immortal John Howard pointed out that severe surgical cases never recovered owing to ill ventilation; for instance, in the Leeds Infirmary no case of compound fracture or trepanning survived. Of modern hospitals no such remarks can be made, and although there is ample room for improvement in their construction and regimen, they have made vast advances towards perfection in the last eight or nine years. This we owe chiefly to that female Howard and greatest of living philanthropists, Florence Nightingale. Her extraordinary labours during the Crimean campaign, when, forgetful of home, friends, or fortune, and unmindful of personal fatigue or danger, she unceasingly strove to save the health and lives of our soldiers, have been recognized by a grateful nation; but her efforts to improve hospitals at home are less known. It is sad to have to record that she has been reluctantly compelled to relinquish her most useful labours owing to her own shattered health. Her work is the most comprehensive treatise on the subject in our language, except, perhaps, the report of Dr. Bristowe and Mr. Holmes, the two distinguished investigators who, in 1863, were commissioned by the Medical Officer of the Privy Council

"To ascertain the influence of different sanitary circumstances in determining in different hospitals (as compared with one another, and where practicable with private practice) more or less successful results for medical and surgical treatment; particularly among patients who are submitted to surgical operations, or have undergone accidental injuries, and among patients suffering from infectious fevers and other kinds of acute disease, and among puerperal women; and with particular reference to the different degrees in which recovery is delayed or prevented by accidental morbid complications."

We have often discussed the dangers of bringing into

crowded space too many healthy individuals, and the danger of aggregating sick people too closely is always to be feared in the construction and management of hospitals. The sick are brought there for the convenience of nursing and medical aid, but so much matter of a hurtful character emanates from the sores and discharges of the sick in various complaints, that unless there be the freest ventilation, many of those who are admitted to be cured are positively injured.

Hospital infection, or pyemia as we call it, is the reputed cause of a considerable number of deaths, but as Mr. Holmes has recently remarked,

"There is a necessity for some careful method of studying the condition of the wards and of the atmosphere of the wards in various states of weather, and at various times of the day and night. It is only by a long series of observations of this nature that the assertions which have been put forth with regard to the origin of hospital diseases from germs present in the air, or deposited on the walls or furniture of the wards, can be verified or refuted."

Mortality in different hospitals varies most widely, and there is no doubt that it is capable of being reduced in those of the highest average by well-organized hygienic improvement; for instance, in twenty-four London hospitals, which, on an average, contain 4,214 patients, there occurred during the year 1861, 3,828 deaths, or 90·84 per cent. per annum upon the inmates, nearly every bed yielding a death within the year; in twenty-five provincial hospitals capable of containing 2,248, 886 deaths, or 39·41 per cent.; and in the Margate Sea-Bathing Infirmary, where there were 133 patients, 17 deaths, or 12·78 per cent. Much of the mortality among soldiers in India and other tropical places is not to be set down to the climate alone, but to the abuse of alcohol, and the unwholesome state of their barracks and hospitals which till lately existed. "Facts such as these," says Miss Nightingale, "have sometimes raised grave doubts as to the advantage to be derived from hospitals at all, and have led many a one to think that

in all probability a poor sufferer would have a much better chance of recovery if treated at home.

However, Dr. Bristowe and Mr. Holmes successfully refute this argument by enumerating the influences which determine the death-rates:

"1st, the position of hospitals in relation to the poor who make use of them; 2nd, the pressure on the resources of hospitals in consequence of disproportion between the accommodation which they are capable of affording and the number of those applying for relief; 3rd, the relative numbers of medical and surgical beds; 4th, the admission or exclusion of cases of infectious disease; 5th, the admission or exclusion of incurable affections; 6th, the admission or exclusion of those who are moribund or dead; 7th, the admission or exclusion of eye diseases, skin diseases, and the like; 8th, the admission or exclusion of trivial cases; 9th, the system of admission by subscribers' letters, and on special taking-in days; and 10th, the carrying on of clinical instruction, or, generally, the degree of interest manifested by the professional staff of hospitals in the study of their profession."

Each of these they most ably discuss, and the 5th they exemplify as follows:

"No one would consider the hospital at Brompton as unhealthy because its death-rate varies from 13 to 19 per cent.; no one would consider the Dublin Hospital for Incurables a pest-house because during one year there were 24 admissions and 13 deaths; or regard (which would be scarcely less absurd) the order of the garter as a fatal gift, because the death rate, calculated on the admissions, amounts to 100 per cent."

They very justly conclude that

"The health of hospitals, so far as we can ascertain, is influenced in a far greater degree by conditions belonging to hospitals themselves than by conditions of external atmosphere, of site, of soil, and the like. And we may add, the healthiness of hospitals is less dependent on the form and size and distribution of wards than it is on ventilation, drainage, cleanliness, and proportion of inmates to space. A hospital of defective construction may by careful attention to these latter conditions be rendered, even in a large town, comparatively healthy; and a hospital built on the most approved plan, and occupying the choicest site, may be rendered in the highest degree unhealthy by their neglect."

If well-ventilated rooms, assiduous nursing, the best

medicines, and the fittest food, could be secured at the patients' home, along with that high-class skill and constant attention which even the foremost in the medical and surgical professions bestow on hospital patients, I have no doubt that the result to which Miss Nightingale alludes would follow; but you will see at once these circumstances are impossible, and therefore, under existing conditions, hospitals must be relied on for the treatment of the severer cases of illness or accident; and their advantages are, at least in this city, fully appreciated by the poor, the greatest anxiety to gain admission being constantly displayed. The death-rate in the Dublin hospitals is much lower than that which Miss Nightingale gives for the twenty-four London ones, as appears from the following figures which I obtained in 1864: In the nine general hospitals in this city—namely, Adelaide, City of Dublin, Jervis-street, Mater Misericordiæ, Meath, Mercer's, Richmond, St. Vincent's, and Stevens', there were admitted from 1st January to 31st December, 1863, 11,991 patients, of whom there died 552, or 46 per 1,000; but even this mortality is made greater, in proportion to that among cases treated at their own homes, by the following circumstances—some of our dispensary medical officers are also hospital surgeons, and most of them are connected in some way or other with these institutions, and while anxious to do the best for the suffering poor, they prefer to have the more acute and serious cases in hospital under their more constant supervision, where also these examples of disease confer the important, though indirect, benefit of serving humanity, by training scientific physicians and surgeons. The difference in mortality in hospitals depends also upon selection of the cases; for instance, in those with large clinical classes, striking and severe examples of disease will be naturally sought for, and sent there by the numerous practitioners who have been educated at the institution. Dr. Guy, the great medical

statist, has shown that the mortality of Guy's, Bartholomew's, King's College, and University College hospitals, range from 110 to 115 per 1,000, owing to the gravity of the cases admitted for their hygienic and curative arrangements, which are the first in the world. To render the statistics of our hospitals more readily comparable with those of London, I have computed from the Census Reports that on the 7th April, 1861, there were in the eight existing hospitals—for the Mater Misericordiæ was not opened—703 patients, and allowing the death-rate to be proportional to what I have ascertained for last year, we would have a per centage of 74 deaths instead of 90, or that of the twenty-four London hospitals. As I have said before in respect to other branches of medical statistics, it would be very desirable that by the extension of registration to hospital mortalities, we would be enabled to obtain fuller and more accurate numbers.

In a previous lecture I have endeavoured to show that some diseases owe their origin, and many their untoward course, to want of ventilation, and I may here express my conviction that with a full regard to the necessity of fresh air in these institutions, the most contagious cases might be mixed up with ordinary patients. But as this perfect airing is not attainable, and for other reasons such an arrangement is not advisable, the innate virulence and unmanageableness of contagion I think has been too much dreaded, to the neglect of simple precautionary measures, as is seen throughout all the old quarantine laws. So close was the affection of contagious matters for substances in particular conditions considered to be, that it was once laid down that feathers just plucked from birds could not be admitted from a plague-stricken country without the most imminent danger. Miss Nightingale argues that fever patients should be mingled with ordinary patients, and if any others catch the infection, it is a

proof of so wretched a sanitary state that we may expect fevers to arise without any germ at all. Sir Gilbert Blane and Prof. Gregory, and Alison, have promulgated similar views. I may, however, mention the fact, to be explained as it may, that there is scarcely a year that the life of some zealous student is not sacrificed, if his benevolence has led him to too close a contact with infectious cases, and the latest instance of death by typhus occurred in the person of one of the residents in Sir P. Dun's Hospital, who had been most energetic during the cholera epidemic.

Separate fever hospitals were first advocated by Dr. Haygarth of Chester, and have since met with general favour, for their advantages are patent. They remove from the filthy homes of the poor the source of disease, which will infect the rest of the family and even the neighbours, and the rich become attacked by the contagion being carried by servants who will visit their relatives when stricken down. By want of ventilation, and the lurking of the poison or continuance of its causes in their homes, the poor get relapses, whereas if removed to hospital their homes can be purified during their absence. In the Cork-street and Hardwicke fever hospitals of this city there were admitted 2,353 patients last year; and probably 500 were treated in other hospitals. Now, as one patient may be fairly calculated to infect four others, and as 1 in 8 of those attacked die, it may be justly inferred that these admirable institutions have prevented 11,412 cases, and 1,424 deaths by fever. Highly, however, as I value these benevolent and admirably conducted establishments, I must acknowledge that till every effort is made to prevent by pure air and water, by perfect sewerage, and as far as possible by good food, in this and other cities, the occurrence of fever, the treating of the disease, may be compared to the task of Sisyphus.

In Glasgow there has been legal power for the estab-

lishment of houses where the families of persons struck down with fever may take refuge during their treatment, or the purification of their dwellings, and such have been erected with the most signal advantage. If similar steps were taken by the benevolent of this city, the spread of fever would be much checked, and the misery which falls on a family when the head of it is removed to hospital greatly relieved. But, indeed, under the Public Health Act there is now power for the Poor Law Guardians to establish refuges of the kind, and they did so during the recent cholera epidemic with most signal advantage, as I shall hereafter tell you.

Dr. Murchison advocates the establishment of separate fever hospitals, and records the following facts :— In the first six months of 1862, 1,107 cases of typhus were under treatment in the London Fever Hospital, and the mortality was 20·95 per cent., while out of 343 patients under treatment in six of the general hospitals the mortality was 23·32 per cent.; 1,080 cases were admitted into the Fever Hospital, and communicated the disease to 27 persons, 8 of whom died, while 272 cases admitted into the above general hospitals communicated the disease to 71 persons, 21 of whom died.

Dr. Parsons, of New York, in speaking of the Bellevue Hospital, says : "Until quite recently this hospital has been the most prolific fever nest in the district, if not the whole city; for not only were cases of typhus fever brought here for treatment, but from these cases the fever was disseminated throughout the hospital, proving fatal to patients that otherwise might not have been exposed to the disease, and to the resident physicians and surgeons of the hospital." In one of the best arranged London hospitals 167 cases of fever were admitted in 1865, and 13 persons, including 6 nurses, caught the contagion.

As the fullest ventilation is required in such hospitals to burn off the peculiar poison of the disease,

they should be never over-crowded. I will adduce for you some instances of evils from the agglomoration of a number of sick under one roof—evils which are almost wholly avoidable, and which will never, I fervently trust, be reproduced on so great a scale. In one of the Scutari hospitals there were at one time 2,500 sick and wounded, and two out of every five of them died—a proportion not, however, equalling the mortality by disease during the first seven months of the Crimean campaign, for 60 per cent. per annum of the troops died, a death rate as high among the soldiers as that of the sick in cholera or plague times in cities. In one month there were in the Scutari hospitals 80 cases of that fearful fruit of sanitary mismanagement, "hospital gangrene." Sanitary improvements, mainly promoted by Miss Nightingale, reduced the mortality among the *sick* during the last six months of the war to nearly the rate of deaths among the *healthy* of the Guards at home. In times long gone by, the Hôtel Dieu, Paris, contained in 1,200 beds as many as 7,000 patients. This was accomplished by multiple beds, and by these being used in turns, "forms being provided on which the sick whose turn it was to be out of bed could rest in the meantime." One out of every four patients used to die. Its air was such as to be called "a most foul and pestilential congregation of vapours." One-fifteenth of the women delivered within it died, and one-third of the children. The itch and other contagious diseases were almost universal among the patients, surgeons, and attendants, and the institution was a vast focus in this way for spreading disease. Even five years ago the illustrious Malgaigne declared that, as regards sanitary conditions, the hospitals in Paris "were the most detestable in Europe." St. Thomas's Hospital, London, was, up to 1741, remarkable for its high death-rate (1 in 10); but, after ventilation and other alterations, it fell to 1 in 15·6. One lesson more, which, from having occurred

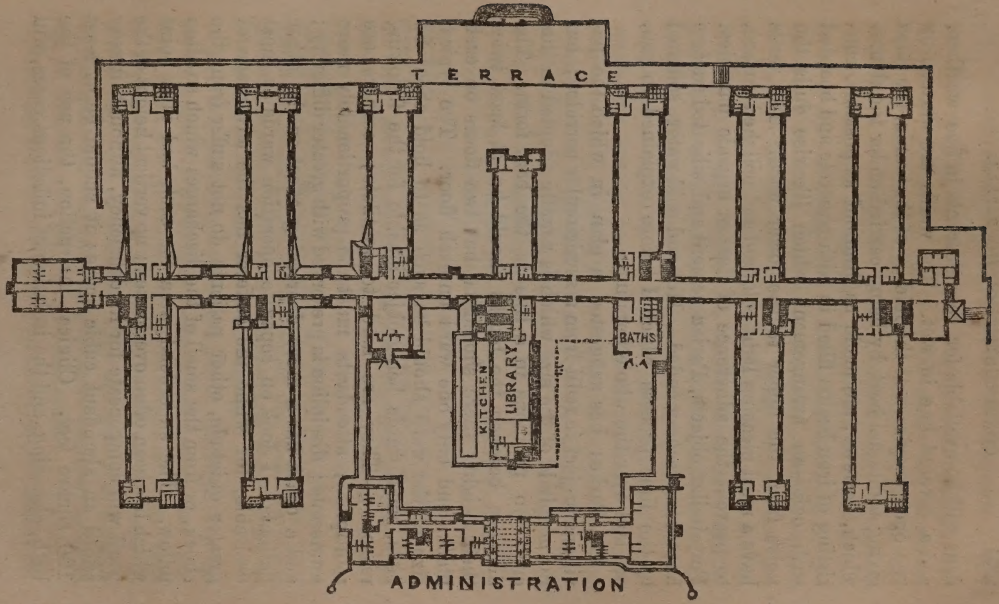
at home and in the memory of us all, may make more impression. In the Irish famine-fever of 1846-7, the rate of mortality in hospitals and poorhouses was far greater than among the poor creatures who lay in the open air along the hedges, exposed to the inclemency of the weather, and without sufficient food or raiment; and during the typhus epidemic of 1814 in Paris, those patients who were obliged to be rudely sheltered in the Montfaucon abattoir, where they were freely exposed to wind, recovered far better than those treated in the hospitals.

With regard to the situation of metropolitan hospitals, while I am fully impressed with the importance of obtaining healthy sites, I do not think all other considerations should be ignored, as they are very nearly by Miss Nightingale, so anxious is she to secure the most healthy positions. She seems to fear opposition from teachers of medicine, and remarks that if medical instruction be an object, it is better that students should watch rapidly recovering than lingering cases, and twice as many cases can thus be submitted to them. Even removal of the hospital to the suburbs of a town, she thinks, would benefit medical education, for "the quiet and studious habits of a college would be substituted for the desultory lecture-hunting and hospital-walking of London." After all, medical education is but a secondary object of these institutions, their primary function being the care of the sick; and when one reflects on the distance a severe accident or acute case should be carried, or the patients' friends should travel in visiting them at a suburban hospital, we must feel some satisfaction that in this city healthy and extensive sites may be had at short distances from the centre at moderate rates.

The first principle of hospital construction, Miss Nightingale asserts, must be, that it shall be built in pavilions or separate blocks, having wards, nurses' rooms, sculleries, lavatories, baths, and water-closets

unconnected with other pavilions save by a common airy corridor, the building for the administrative part of the establishment being central.

The Herbert Hospital, near Woolwich, is the most scientifically constructed hospital in Europe which I have visited, and forms a noble monument to the truly great man after whom it is named. It consists of seven pavilions, the ends of which all project into free air, as will be understood by studying the plan, and which are separated from each other by twice their height in distance. Below the wards there is a basement story, which accommodates the museum, library, medical officers' rooms, and stores. There are but two floors to each pavilion, and each ward has a large end window commanding beautiful prospects, in front towards the Thames, behind towards the Crystal Palace—the latter, however, not being improved by a cemetery a quarter of a mile distant. The baths and water-closets are in the free ends, and the latter are thus thoroughly aired. The drain-pipes are aired by a shaft carried above the roof, a box of charcoal being adjusted to the end. Each ward is 26½ feet wide and 14 feet high, which latter measurement is below what we would wish for, and contains 30 beds, making 650 altogether, the cubic space for each being therefore about 1,300 feet. The windows are abundant, there being one for two beds, and arranged along opposite walls, and as the axis of the wards is a little to the east of north, each side will be enlivened by the sun during some part of the day. The central blocks contain the administrative quarters, kitchens, library, and convalescents' day-room ; one end has lunatic wards, and in the other is the operation theatre, with a few beds attached. The conveyance of food, medicine, and coals, and the removal of refuse, will be carried on by means of lifts and shoots in a basement corridor along the centre, so that no bustle will disturb the patients. Open corridors looking on beautiful gar-


TERRACE
KITCHEN
LIBRARY
BATHS
ADMINISTRATION

dens will be available for convalescents in fine weather, and a covered one in wet. The wards are warmed by two open fireplaces at the middle of the wards, the flues giving additional heat by being carried under the floors, which, however, are made as fireproof as possible, consisting of iron beams filled in with concrete and boarded with oak—an arrangement which likewise dulls the noise from the upper to the lower ward. The walls have a most pleasing light coloured and polished surface, to prevent the adherence of dust or organic particles. For similar objects, Parian cement and silicated surface have been recommended. Hot and cold water, softened by the lime process which I before explained to you, are laid over the whole building.

Dr. Parkes has suggested a plan in which the pavilions project in radii from a semicircular corridor; but for hospitals of the size which is usually adopted in this city, two pavilions in a line is the best form. The distance between the blocks should be at least twice their height; there should be but two floors on each block, and only one ward on each floor. The typical size of the ward should be such as to hold about 30 beds, small wards being objectionable for the following reasons:—They are hard to ventilate; corners are multiplied; attendants must be proportionately more numerous; discipline is preserved with greater difficulty; and a death has a more depressing effect on the other patients. I look on separate operation wards as most desirable, for while the sufferer has the advantage of greater quietude, other patients do not suffer from the shock, or from the smell of the discharges which so often follow. The superficial area for each bed is a point which has been often overlooked; no vertical height of the ward will compensate for its deficiency, although it may afford an abundant cubic space; it should be at least 100 square feet. Clinical instruction, the use of the bath, cleansing, and the isolation of infectious cases, will

be then readily attainable, and with wards fifteen feet high, each patient will have 1,500 cubic feet of space. In a previous lecture I dwelt at some length on the ventilation of hospitals, which, considering the abundance of organic emanations, should be the best ventilated of all buildings, and I stated that air-shafts were necessary to attain perfection of airing, which consists in the air the patients breathe being as pure as the outer air, without their being chilled. Lévy, the first of French hygienists, says: "I am far from denying the importance of diet, of curative methods, of careful attention, of an efficient administration, &c.; but all these elements of hospital service are secondary to the necessity for having pure air." In fever, hospitals free access of air is especially required, and no plan can be more effectual than that adopted by the Commissioners of Health during the epidemics from 1846 to 1850. It is described in the following words:

"A sheet of zinc or tin plate is punched (not drilled) with holes one-twelfth inch diameter, and half-an-inch apart; thus prepared, it is inserted in place of a pane of glass in every window, or every alternate window, as required, care being taken that the side *on which the burrs project is turned to the weather, so as to throw off the rain.* Neither wire-gauze nor perforated zinc of the ordinary kind will be found suitable, as both permit blasts of cold air and rain to pass through them, and the former is liable after some time to become choked with dust. Those who have had practical experience of the importance of ventilation to the sick, and of the difficulty of maintaining it, will appreciate the value of a simple plan that combines utility with cheapness, and which cannot be interfered with by the inmates of the hospital."

You are, perhaps, aware that Sir D. Corrigan has for many years advocated this mode of ventilation, and they have been found, during an experience of fourteen years in the Hardwicke and Whitworth Hospitals, superior to all others. As he remarks, they are beyond the reach of the inmates, who have the stongest tendency to close up or obstruct with clothes all ventilators.

I am an earnest advocate for numerous windows in

hospitals, both on the score of ventilation and of light; the patients, if convalescent, should be enabled to read in bed, or to enjoy the prospect of scenery or gardens, which should always surround the building. The window space ought to be half the wall space, notwithstanding the low temperature of this climate, which may be compensated for by additional production of artificial heat or clothing, or by double sashes or panes, which are very useful in preventing extremes of heat or cold. For similar reasons, the walls and ceilings should be of a light colour; and to prevent the adhesion of dirt their material should not be porous, but hard and polished; pale green paper (not arsenical), varnished, has been found most economical and suitable in this city; but Parian cement, if it can be afforded, is the best possible surface. Whitewashing of walls, to be effective for the removal of carbonic acid, must be renewed every three or four weeks, to the intolerable disturbance and even danger of the patients; and we have already learned that that gas is by no means the most noxious constituent of foul air: ordinary plaster becomes in a few years loaded with organic matter most abundantly. The surface of the floor should be made polished and impervious to moisture, as advantageously adopted in many institutions in this country. The frequent washing of floors is hurtful, as the subsequent evaporation carries up organic matter, and erysipelas has been proved to have been thus rendered frequent. The stairs and landings should be of stone. The furniture should be as little as possible—thin mattresses on springs and iron bedsteads being the most advantageous. There are many improvements in bath-rooms and lavatories, sculleries, water-closets, and sinks, which if carefully attended to in hospitals would not only expedite the recovery of its inmates, but inculcate wholesome lessons applicable to their homes when they return to them. Care should be especially taken in building latrines,

which, projecting at the end of the pavilion, should have the closets along their outer wall; and for better ventilation, the partitions should not reach the ceiling, and the whole apartments should be aired by opposite windows kept open. The hospitals in this city, though small, are numerous in proportion to the population, and I think we have cause for congratulation in this circumstance, for multiplication of these institutions is more desirable than enlargement. It may be said that extensive fields for clinical study are not presented, but by a system of reciprocal admission to hospital students, as was mooted some years ago, this may be obviated. The distribution of the nine general hospitals I exhibit to you on this map.

The report of Dr. Bristowe and Mr. Holmes, to which I have so often alluded, concludes with a special description of each hospital, and it appears that their impressions of those in this city were, on the whole, favourable.

A few words about a uniform plan of hospital statistics, the advantages of which would be as follows:—We could ascertain the mortality of different hospitals in various diseases or accidents; and as some cases might be more advantageously managed in one hospital than in another, owing to climatic or hygienic conditions, great benefits and economy of the funds should result. The laws which govern disease and the influence of particular remedies could be studied from accurate and copious data, and also the utility of various operations, many of which, from the limited experience of one man, may now be brought into undue prominence. No form could be better for the purpose than that which Miss Nightingale has drawn up, and which has been adopted by the International Statistical Congress, St. Bartholomew's, and London Hospitals, and similar institutions. The medical officer of the Privy Council reports on this subject as follows:

"During the present grievous imperfectness of hospital statistics, we cannot accurately compare, even in part (much less in entirety), the success of one hospital with the success of other hospitals, nor, *à fortiori*, the healthiness of one hospital with the healthiness of others. And I deem this to be a public wrong, and a bar to scientific progress. But meanwhile, happily for mankind, hospital unhealthiness is not a something about which no judgment can be formed, or which must needs wait unamended till by elaborate comparative statistics we have its exact mathematical measure before us. Sanitary defects, where they exist in hospitals, are appreciable by the skilled daily observers of the sick—appreciable in individual cases, and according to common hygienic laws, as causes of disease or interruption of recovery."

In Paris, a governmental department (Bureau de l'Assistance Publique) controls all the hospitals, and yearly publishes their death-rates and other records. Two great convalescent asylums in the suburbs form part of the system of medical relief in that capital.

It seems to me by no means necessary to separate children altogether from adults, as done in the Children's Hospital in London, Edinburgh, and Paris. A separate ward has been used for over 30 years in St. Vincent's Hospital, and this, and the Smyly ward of the Meath Hospital, have shown that isolation of children from the adult patients is very advantageous.

I will not enter into the vexed question of hospitals for special cases, nor discuss whether it is politic and just towards the medical profession to receive well-to-do patients for payment, a system which is not adopted in any town in the United Kingdom except Dublin. With regard to abuses which occur in connexion with hospitals, Dr. Markham, now Poor Law Inspector, a few years ago, made the following truthful remarks:

"My desire is simply to establish the fact, that our medical charities are not adapted to the present condition of society; that whilst doing a vast amount of good, they are also doing a large amount of mischief, by teaching the working man improvidence; that they unduly call upon the benevolence of the generous, and thereby spare the pockets of that very large class of the churlish opulent who "give nothing;" that a very large number of persons are per-

mitted to share their benefits who are as well able to pay for relief as the governors of the charities themselves; that the medical profession is thereby robbed to an enormous extent; and that the plain and simple cure for these evils, is the converting of our hospitals and dispensaries into provident medical institutions."

In Dublin the House of Industry Hospitals (Richmond Surgical, Whitworth Medical, and Hardwicke Fever), which are supported wholly by Government, as well as, to a certain extent, the Lock, Stevens', Meath, Cork-street Fever, Rotundo Lying-in, Coombe Lying-in, St. Mark's Ophthalmic, and the Incurables, Hospitals, which are partly supported by parliamentary grants, are regulated by a special act, passed in 1856 (19 & 20 Vict. cap. 110). The buildings and land of the House of Industry are vested in the Board of Works; but in other respects the institution is managed by a Board of Governors, partly nominated by the Lord Lieutenant and partly by the subscribers. Officers of these hospitals and of the Lock Hospital may, if incapacitated, receive annuities out of the funds granted by Parliament. The Lord Lieutenant can appoint the Board of Superintendence of the Hospitals, which shall consist of not more than twelve members; and one-third of those appointed have been medical men. Their duties are, to inquire into the performance of the duties of officers, to superintend the general management of the institutions, to frame, subject to the Lord Lieutenant's approval, rules for the purpose, and to report annually to Parliament on these matters.

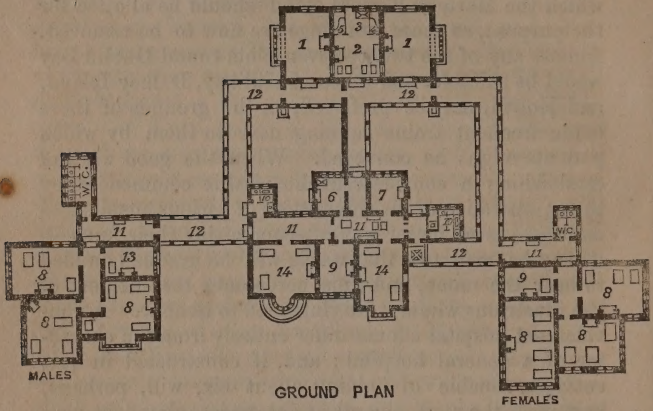
I regret that time will not permit me to give you details relative to each of the many benevolent institutions of which Dublin can boast. If it did, I would have no hesitation in canvassing the peculiarities and historical facts relative to each of our hospitals, for so careful is the superintendence over those which are endowed, and over those which Charity—that virtue of all most blessed—supports, that I would only have to use terms of commendation. With respect to the advan-

tages of hospitals for incurables, they are, indeed, most truly illustrated by the admirable institution of that nature which we possess in Dublin. In London, or rather its vicinity, there are institutions which may be regarded as convalescent hospitals, but in this country we had, until the present year, no such institution, although its desirability, or indeed absolute necessity, had been often demonstrated, and, first, by the Royal Report on the state of the Irish poor, Dr. Whately, Archbishop Murray, Mr. More O'Ferrall, and Mr. Naper being among the commissioners. The Sisters of Charity have established, in connexion with St. Vincent's Hospital, a Convalescent Home at Linden, Stillorgan, and I can testify to the advantages in the way of rapid recovery after acute disease, and improvement of scrofulous cases which have already accrued. Funds are being collected for the establishment of another such institution on an adjoining site. The change of air and of scene recruits health most rapidly, and many an artizan, if sent back, even after the most successful treatment, to his cheerless and unwholesome dwelling, relapses, or incurs the risk of other maladies. As the Sisters urge, "Few but those who are well acquainted with the different phases of languor, weakness, and prostration consequent on more serious maladies, and at the same time with the privations of the poor, who can so little afford the comforts, or even the time necessary for complete restoration, can judge how great the boon and blessing to them of finding a temporary home where they may freely, and at full ease, breathe the pure country air, and enjoy its energizing effects for a brief interval before returning to their daily cares." These institutions deserve the support of the working classes—who lately subscribed £850 for a similar one in Birmingham—as well as of the wealthier classes, who can find no nobler cause in which to exercise their benevolence. During the American war the convalescent homes, or "rests,"

as they were called, which the Sanitary Commission established, saved thousands of lives. The daily papers, about two years ago, contained most convincing letters upon this subject, recommending that testimonials to departed great ones should take this form, in place of useless erections which have too often disfigured instead of beautified our city, and one of the most influential of them has recently urged that the plots of ground upon which the Martello Towers stand should be allotted for the purpose, as these buildings are now to be removed. Almost any of the twenty-seven plots round Dublin Bay would be suitable, and those at Killiney, Dalkey Island, and Howth, may be preferred, on the grounds of there being frequent trains running near to them by which patients might be conveyed. When the good work of establishing a convalescent hospital is commenced by the co-operation of the committees of various hospitals—and there is no better way of economising their funds—it may be expected that wards will be gradually added to bear the name, and thus perpetuate the memory of the illustrious whom it was intended to honour. A convalescent hospital should differ entirely from the character of a general hospital; and, if constructed in neat cottages capable of holding about six, will, perhaps, best meet the requirements of cheapness, abundant ventilation, discipline, and good example, by which the homes of the poor will afterwards profit. The sketch and plan on following page are copied from those made for the Wilts Herbert Memorial, and published in Miss Nightingale's book. In such an institution abundant employment of body and mind would be an important element of cure.

It is in warfare that scientific knowledge, with regard to the construction of hospitals, is fully called into requisition. The Federals, during the American war, according to the official reports, having 97,751 sick and wounded, constructed numerous provisional hospitals.

PRINCIPAL ELEVATIONS



GROUND PLAN

CONVALESCENT HOSPITAL.

1. *Dining and Day Rooms.* 2. *Kitchen.* 3. *Scullery.* 4. *Larder.* 5. *Stores.* 6. *Dispensary.* 7. *Maid-servants' room.* 8. *Convalescents' Bedrooms.* 9. *Sisters.* 10. *Baths.* 11. *Corridor.* 12. *Covered way.* 13. *Gardener.* 14. *Sick Wards.*

From the reports, it would appear that humanity and philanthropy united never made such gigantic efforts. In a few months 214 hospitals, containing 133,800 beds, were erected, and the sanitary commission expended nearly £9,000,000 to assist the government in providing for the patients. It may be right that I should allude briefly to hospital nursing. By the Census of 1851 it appeared that in England alone there were 25,466

"nurses," although no provision till very lately existed for their training. My friend, Dr. O'Sullivan, of the North Infirmary, Cork, thus sketches the faults of paid nurses :

"It is not unusual to find that the taking of medicine ordered by the physician has been left to the option of the patient; meals have been given frequently with great irregularity; bad cases, unable to feed themselves, have often been left uncared for until it was the nurse's convenience to assist them, or until neighbouring patients came to their aid; food has been left to cool, and oftentimes allowed to go to waste when the patient cannot take it, 'poultices were put on cold, or left on till they were hard, and then not washed off; bed sores were unattended to till they had become so bad that the medical officer's attention was called to them;' patients were left dirty; utensils were often left unwashed; 'patients ordered to remain in bed were as often out of bed;' they were allowed to smoke in the wards; their beds were not regularly made up; patients were allowed to hide their soiled clothes under their beds; and a host of other important, as well as minor details, neglected."

The nursing by Sisters of Charity in St. Vincent's Hospital was established in 1834, and sisters trained in France were placed over it. The system has worked most admirably, and in every way superior to any system of paid nurses. There is one sister to about every twelve patients. She remains in her office off the ward, or in the ward, from about 7 A.M. to 9 P.M., with short intermissions for meals or prayer. She does all the duties comprehended in the word "nursing;" but ward-maids, of course, take all the scrubbing and cleansing duties. I am glad to have this opportunity of advocating the system of "hospital sisters," which is carried out in University, King's College, and St. Thomas' Hospitals, London, as I am strongly of opinion that it might be adopted in those hospitals in this city where at present the entire care of the sick is intrusted to paid nurses. In University College Hospital, the sisters come from respectable ranks in society, and belong to the All Saints' Home, an institution in connexion with the Church of

England. They each superintend a ward containing fifteen beds, their principal duties being to direct the nurses. In King's College Hospital they are termed "lady nurses;" they superintend the paid nurses, and it is found that their presence has the greatest influence in elevating the moral tone and civilizing the habits of the patients. At both hospitals their services are rendered gratuitously (the sisters and "probationers" in King's College Hospital paying for their board). They are willing to give, but never obtrude, religious instruction and consolation to those who seek it, and it never assumes a controversial character.

Miss Nightingale seems to infer that if the entire establishment be administered by hospital nuns, Protestant or Roman Catholic, there will be lower average care of the sick, as "the idea of the 'religious order' is always more or less to prepare the sick for death." This opinion I cannot support, for I, in common with all other medical officers of hospitals under the care of religious orders in this city, have certainly never had to complain of want of anxiety for, or of attention to, mundane matters on the part of these sisters.

If, then, sisters in these London hospitals be so really useful, they seem required in even a greater degree for our poor—uneducated, and previously uncared-for. The step has been taken in Dr. Stevens' Hospital, under the superintendence of some benevolent ladies, and a lady who acquired the system in the nurse-training department established by Miss Nightingale. There can be no doubt that many of our devoted fellow-countrywomen will readily apply themselves to the beneficent task; and besides the care of the sick, another field of usefulness will be opened, namely, the training of nurses for the rich at their homes, which had been previously unattended to, save in the case of those who are called to succour mothers in their hours of trial.

LECTURE XII.

DWELLINGS OF THE LABOURING CLASSES—LODGING HOUSES—TENEMENTS—BUILDING ACTS.

HAVING in my earlier lectures referred to the over-crowded and wretched state of the dwellings of the poor in Dublin, I will not dwell on this part of the subject at any great length now. I endeavoured to show that "out of dirt comes death," just as surely as from the accidental causes with which Providence removes us, and although bad air does not burn, suddenly poison, or drown him who inhales it, it depresses, removes appetite and energy, and keeping the flow of life at a low ebb, predisposes to mortal disease. Such evils were brought to light a short time since in that most neglected part of London, Bethnal-green, where very many deaths occurred from a kind of blood-poisoning due to over-crowding; and the effects upon children of the same crying evil is exposed under the title of "Infanticide without Intention" in Mr. Godwin's most able book entitled, "Another Blow for Life," as being most rife in every part of London. As is the home, so are the people in regard to moral and social state, and although the nests of crime which infest the worst parts of London have happily no analogue here, yet there are "filthy dens in which men, women, and children, are brutalized and destroyed."

The instance given by Mr. Rendle, a Metropolitan Medical Officer of Health, is most applicable to the condition of our city poor: "Let us picture to ourselves the man of the alley come home from his work; the house is filthy, the look of it is dingy and repulsive, the air is close and oppressive; he is thirsty, the water-butt,

decayed, and lined with disgusting green vegetation, stands open nigh a drain, and foul liquids, which cannot run off, are about it, tainting it with an unwholesome and unpleasant taste; the refuse-heap with decaying vegetable matter is near, and the dilapidated privy and cesspool send up heavy poisonous and depressing gases." Is not the sumptuous gin-palace a tempting resource?

The most crying evil of large cities is the degraded state of the tenemental dwellings of the poor, some of whom are thereby lowered almost to that state of physical and moral decline which in American cities is recognized by a name less elegant than expressive—"tenant-house rot."

The dwellings of the poor in cities, towns, and rural districts in Ireland are ill-constructed, dilapidated, overcrowded, and unwholesome. Let me attempt the description of one or two in each of these situations—but if they were photographed, or sketched by an artistic pen, they would excite as much interest as the exposure of Bethnal-green. Gill-square is a blind court, opening by a narrow archway, under one of the houses in Cole-alley, Meath-street, in this city. Built on three of the sides of a square of about fifty feet, there are nine three-story houses; the roofs are broken, the walls present a most unsafe and tumbledown aspect, the windows are boarded up for more than half their space; beings whose dirty, ill-clad, and spiritless aspect it is saddening to behold, overcrowd every room to the utmost; there is but one yard for all, and in this, till last year, there was a hovel about eight feet square and ten high, in which three adults were huddled. Here, however, time has wrought improvement, for there now remains but a heap of rubbish. If I had time, or if it were my province to depict the moral features of the denizens, they would appear of even a more degraded character than the buildings,

and of no place could the words of Kingsley be in every circumstance more truly descriptive :

"I turned into an alley 'neath the wall,
And stepped from earth to hell. The light of heaven,
The common air, was narrow, gross, and dun;
The tiles did drop from the eves; the unhinged doors
Tottered o'er inky pools, where reeked and curdled
The offal of a life; the gaunt-haunched swine
Growled at their christened playmates o'er the scraps.
Shrill mothers cursed; wan children wailed; sharp coughs
Rang thro' the crazy chambers; hungry eyes
Glared dumb reproach."

Such were the worst parts of London—undrained, dilapidated, and thinned by pestilence every few years before the fire of 1666, which therefore cannot be regarded from every point of view as a calamity.

56 Bow-lane, west, I have described in a recent report to the Corporation, as follows :

"Hall and stairs covered with three inches of crusted filth; first flight so rickety as to be unsafe; second without a bannister; floor of second landing broken into two holes about a square foot each, dangerous to life and limb; ceilings of both top floors broken, and let in rain; no lower sash in window of back room, so that it had to be covered with a petticoat nailed over it—such state would produce colds and rheumatism; filthy privy, and back yard without a sewer—prolific causes of diarrhœa."

Poverty of the owners is not the cause of the dilapidation of this kind of abode, for many of the persons who set them have raised themselves to comparative affluence by profits thus gained from the poor.

Other such tenement houses are owned by respectable persons, who live perhaps far away and never enter them, but leave them to be managed by the "deputy" or agent, who is not usually of an improving spirit. In proportion to space they are highly rented—far more so than the gentleman's house. The poor often regard the fixity of windows as the perfection of house architecture, for thus the foul air of back yards is excluded, and in a few instances I am really inclined to agree with them.

Every crevice is carefully closed at night. In many parts of the city there are very high houses set to the poor, especially in neighbourhoods which have declined, and these are extremely hurtful by exclusion of sunlight and free circulation of air from other houses around them.

In Cork things are no better, as we learn from recent reports of the Sanitary Committee:

"The overcrowding of the wretched tenements in which they live, each house containing several families, ranging in the aggregate, in some instances, from thirty to sixty human beings, male and female, in each house; for which large rents are exacted by the landlords, who will not spend one penny in the cleansing or improvement of their houses, unless coerced by force of the law to do so. Your committee have learned that a practice prevails amongst poor families occupying rooms in these houses, to underlet a portion of their rooms to nightly lodgers—an evil which it appears to your committee might be met by the enforcement of the Lodging House Act."

The labourers' cottages in small towns are usually built in lanes, and are often placed back to back, excluding all chance of thorough airing, or the provision of sanitary accommodation. They consist of a single room, or a living room, and a sleeping place of about twelve feet square, and eight feet high, which offers for the breathing of the five inmates (the average) and the vagrant, who is almost invariably accommodated with a night's lodging, about 192 feet of space each, 1,000 being the average in public institutions. This would not be so hurtful if there were any means of renewing the air within it; but from the absence of a chimney in the sleeping room, which is usual, and the small size and immovable state of the pane which represents the window, no ventilation occurs. In such an over-crowded state there can be no decent separation of the sexes. When a death from contagious disease occurs in such an abode, the retention of the body within it is fraught with fearful evils; and since the abolition of the Vestry Act

there were no funds for interment; and if the relatives were unable to provide them, they had to beg the amount from the neighbours. Sir Hervey Bruce has, however, obtained an Act last session which empowers Poor Law guardians to bear the expenses of interment. Neither in such a room can ablution of the whole body be accomplished; and, as I stated to you before, I have frequently found persons (especially females) suffering from skin diseases and other maladies, who for many years had never washed any part of their bodies but the face, neck, and hands.

Evictions, and the demolition of cabins in the rural districts, have driven agricultural labourers into the small towns; and, as new abodes in the place of those removed would be subject to taxation, they have not been erected. Besides the fearful over-crowding thus induced, the labourers have to expend their strength in walking long distances to their work. My friend, Dr. Mackesy, of Waterford, has ably drawn attention to these facts. The remedy is that which followed in England last session upon a masterly demonstration of its necessity by Dr. Hunter of the Medical Department of the Privy Council—namely, union rating, for which a Bill was introduced by the Members for Dungarvan and Limerick last year.

The mud hovel of the southern and western peasant is too well known by the sketches of English tourists to need any description here. Planted anywhere, regardless of situation or soil, the low walls, the black, half-rotten thatch, the want of any proper flue, of windows, or of a back door, precluding thorough airing; the clay floor, which becomes soaked with the pigs' food or more dangerous filth, and which Erasmus, centuries ago, showed was the promoter of fever among the English cottiers; and the adjacent manure heap, are all highly promotive of disease.

If there be an inner room, it is close and stifling, and

so ill-lit that when the doctor pays his visit in the daytime, a candle is required to permit him to see his patient. Although wages is much higher in Connaught now than ten years ago, little improvement has occurred in the domestic habits of the people, as they are ignorant of the means of preserving health. The admission into the cabin of animals—the pig especially—has done much to propagate measles and other parasitic diseases, which, as we saw in a previous lecture, are afterwards injurious to man when their flesh is used. These abodes, however, are much fitter for swine than men.

Dr. Tucker of Sligo draws the following lamentable picture concerning the hovels of the western poor:

"The medical officer of a district has the best opportunity to illustrate this sad state of existence. Some short time since, I noticed the homely hovel of a small farmer (the tenant of a nobleman) which may be taken as the prototype of many in country districts. It was about twelve feet wide and twenty-four feet long. The domestic circle, happy family, or menagerie, that dwelt therein consisted of a sick man, his wife, four daughters, one son, three cows, one horse, two calves, two pigs, and poultry—all in one common undivided house—no partition. Generally the pigs dwelt beneath the beds, the people in them, and the poultry over head. They can enjoy the prospect of bacon and chickens which they seldom taste. An aboriginal from Maherow, named Heraghy, observed to me, in defence of this sad social state, that 'it was better have that house full than empty.'"

The poor are apt to huddle together, especially during winter, and in improved dwellings freer air supply will entail the free use of coal. Habit produces a degree of toleration, else the poorest Chinese—whom we are told are often packed in rooms which give but 35 cubic feet of space per head—could not survive.

Many diseases are produced, promoted, or rendered more fatal among the poor, and, if contagious, spread to the rich, by such conditions as I have sketched—a subject which is discussed in other lectures.

Accidental deaths occur likewise by over-crowding; thus, during the last ten years, in Liverpool, 828 deaths of infants have been caused by overlying.

The other physical and the moral evils which result from the wretched condition of the habitations of our poor, we cannot now discuss, but they are subjects pre-eminently important for the philanthropist and the statesman. The evils which neglected dwellings impress on our countrymen are carried with them when they emigrate to British and American cities, in which the term "Irish" or "Irishtown," applied to a neighbourhood, is the synonym for "wretched and filthy;" and, galling to our national pride as the expressions are, no candid man can deny that there is some truth in them. Good houses in these cities depress in value at once when let to our countrymen. Any efforts to educate the younger people in healthy and cleanly habits at home would at once produce improvement, and their benefits have been attested by Messrs. Mayhew, when they investigated the condition of the poor Irish in London. It becomes the duty of every man to lend his aid in removing the causes which lead to such universally recognized degradation.

The report of the New York Council of Hygiene displays a fearful condition of the tenement houses of that great city—nearly half a million resided in 15,000 houses which belong to that class; and in one of the wards the concentration of population was shown to be 265,000 to the square mile. In one tenant-house, which lodged 504 persons, the annual number of deaths by scarlatina had been 16, from small-pox 6, and by fever, very many. On the day of the inspector's visit, 127 of the inhabitants were found to be ill. It was in this very house that the cholera epidemic of 1854 began. Mr. A. T. Stewart, the great Irish-American merchant, has intimated his readiness to give one million dollars for the erection of tenement houses for the de-

serving poor of New York, if the land required is provided.

There are in Ireland, according to the last Census, 89,374 mud or sod hovels of one room only, and 489,668 mud houses with more than one room, giving an increase in Connaught of 5,168 of the latter class since 1841. The average number of persons occupying each of these dwellings is, in towns, 4·53; and in the rural districts, 5·24.

Now, the remedy for this deplorable state does not lie in the labourer's hands, however great his willingness to pay for better accommodation, but with the landlord, when he recognises the duties which appertain to his property. When a poor tenant complains of any unwholesome state of his room, a common answer is, "Leave it; I can let it to plenty of others."

The medical officer of the English Privy Council puts such facts respecting the sister country so eloquently and so authoritatively, that I shall read you his lessons rather than my own:

"It is scarcely possible for the better-off classes to imagine where duty has not given them opportunities of practically knowing, what immensity of baneful influence is included in the evils to which I advert; and it may therefore be well for me to show what in practice are the forms in which the evils present themselves. By places 'unfit for human habitation' I mean places in which by common consent even moderately healthly life is impossible to human dwellers—places which therefore in themselves (independently of removable filth which may be about them) answer to the common conception of 'nuisances'—such, for instance, as those underground and other dwellings which permanently are almost or entirely dark and unventilable; and dwellings which are in such constructional partnership with public privies, or other depositories of filth, that their very sources of ventilation are essentially offensive and injurious; and dwellings which have such relations to local drainage that they are habitually soaked into by water or sewage; and so-forth. But beyond these instances, where the dwelling would, I think, even now be deemed by common consent 'unfit for human habitation'—instances, varying in degree, are innumerable, where, in small closed courts, surrounded by high

buildings, and approached by narrow and perhaps winding gangways, houses of the meanest sort stand, acre after acre of them, back to back, shut from all enjoyment of light and air, with but privies and dustbins to look upon; and surely such can only be counted 'fit for human habitation' while the standard of that humanity is low. Again, by 'overcrowded' dwellings I mean those where dwellers are in such proportion to dwelling-space that no obtainable quantity of ventilation will keep the air of the dwelling-space free from hurtfully large accumulations of animal effluvium—cases where the dwelling-space at its best stinks more or less with decomposing human excretions, and where, at its worst, this filthy atmosphere may (and very often does) have, working and spreading within it, the taint of some contagious fever. In its higher degrees 'over-crowding' almost necessarily involves such negation of all delicacy, such unclean confusion of bodies and bodily functions, as is rather bestial than human. To be subject to these influences is a degradation which must become deeper and deeper for those on whom it continues to work. To children who are born under its curse it must often be a very baptism into infamy. And beyond all measure hopeless is the wish that persons thus circumstanced should ever in other respects aspire to that atmosphere of civilization which has its essence in physical and moral cleanliness, and enhances the self-respect which it betokens. And as a particular class of cases, in which both evils are combined to one monstrous form of nuisance, I ought expressly to mention certain of the so-called 'tenement-houses' of the poor—especially those large but ill-circumstanced houses, once perhaps wealthily inhabited, but now pauperised, and often without a span of court-yard either front or back; where in each house perhaps a dozen or more rooms are separately let to a dozen or more families, each family with but a room to itself, and perhaps lodgers; and where in each house the entire large number of occupants (which even in England may be little short of a hundred) will necessarily have the use of but a single staircase, and of a privy which perhaps is placed in the cellar."

Dr. Parkes tells the same story: "In my course of inspection of these villages (round Southampton), I was satisfied that the labourers of England live as their rude forefathers did—in utter ignorance and contempt of all sanitary laws, and even of the common rules of decency and cleanliness."

The means which legislation has heretofore provided for the improvement of the dwellings of the humbler

classes have been inspection and the advancement of government loans.

Under the Dublin Improvement Act of 1849, and the local acts of three or four other Irish cities, bye-laws were already in force regarding the following matters in nightly lodging-houses :—Registration ; inspection ; number of lodgers ; separation of male and female lodgers ; airing and cleansing ; notice of infectious disease and disinfection ; water supply, and domestic accommodation ; exclusion of swine and other animals ; and the keeping of a copy of the regulations in each room.

Inspection in towns in Ireland was also allowed in nightly lodging-houses, when the population exceeded 3,000, and the town had been placed under Commissioners by the adoption of the Improvement Act of 1854. In England exemption is only granted for those below 200, and in Scotland below 700. Over-crowding is thus irrepressible in hundreds of towns which fall below that population ; and in Parsonstown, Arklow, Kilrush, Portlaw, Roscrea, Macroom, and Boyle, although above it, because they have not adopted any Improvement Act. As an example of a town which is over-crowded by the reception of vagrants at night, I may mention one very near us—namely, Swords. As few of the towns which have adopted the Act of 1854 employ any inspector, it follows that nightly lodging-houses are unregulated in Ireland, except in a few of the larger cities.

Power to inspect the tenemented dwellings of the poor in the same way as common lodging-houses had been advocated by the ablest writers, and first and most forcibly by the Rev. Charles Kingsley ; but until the Public Health Act passed last year, Dublin was the only city in these kingdoms to which it had been granted. Such powers were conferred in 1865 under the Dublin Improvement Act, and were anxiously sought for by London and other English cities, through their health-officers and representatives.

The practices of house-jobbers seem to be similar in all countries. The central Board of Health of Belgium, reporting on tenanted houses, says:

"In these wretched habitations everything is sacrificed generally to the rapacity of the proprietor. Every repair which affects the health or the comfort of the tenant merely, and that is not necessary to prevent the total ruin of the dwelling, is entirely neglected. What is the use of cleaning the walls for people whose habits are filthy? Why make windows for the entrance of air and light, or repair a sewer, or cleanse an alley covered with stagnant water, for people who are accustomed to pestilential smells? It is what a proprietor can never understand. Do not believe, however, that these dreadful abodes are rented at their proper value. On the contrary, the unfortunate people obliged to live in these houses, because all better ones are closed against them, in reality pay a higher rent than for a wholesome room in a good house."

The advantages attending inspection of nightly lodging-houses induced the Corporation to seek power over tenements set weekly at rents under 3*s*., and the Lord Lieutenant sanctioned the bye-laws which were framed in accordance with the Act. The owners of some of these houses, which number about 9,000 of the entire houses in the city, at once formed themselves into a body, with the grandiloquent and scarcely intelligible title of "The Antipolitical Ratepayers' Protective Association," whose object, like that of many similar organizations in England, was to protect themselves from the outlay necessary to render the houses fit for human habitation. By representations that the dwellings of the poor were in excellent order, that the Corporation were about to apply the bye-laws for the regulation of furnished nightly lodging-houses to tenement dwellings, by memorializing that body, and threatening many of its members with opposition at the next election, and by appeals to the police magistrates, they for some months, to a certain degree, impeded us, notwithstanding the deplorable state of houses, such as I have exemplified, in Gill-square and Bow-lane. In a few days I was able to appeal to 165

such houses, the state of which justified the Corporation in their course, and an energetic statement to the same effect was signed by every dispensary physician in Dublin. In May last, however (the question having been argued by most eminent counsel), the police magistrates decided in favour of the Sanitary Committee, and fined the Secretary of the Association for not having registered a house kept by him. So determined were their efforts to oppose us in carrying out the sanitary bye-laws, that they lodged an appeal to the Court of Common Pleas, in which the decision was confirmed. They complain that the term "common lodging-house" is an opprobrious epithet to apply to houses set in tenements. The difficulties of keeping a registry of 9,000 houses, with changing owners, are so great, that I think registration should not be required for "tenement houses," as distinguished from common lodging-houses, in which such a system is necessary.

The artizan and poorer classes of this city, who number about 100,000, dwell in some 9,000 houses, each room of which is usually let as a separate tenement. The Corporation gained by the recent Act the power to compel the owners of these houses to put in thorough repair, and keep so, their roofs, walls, and chimneys; to have their windows kept clean, and glazed, and movable at the top or bottom; and to keep a properly-trapped house-drain and other sanitary requisites in good order.

The bye-laws came into action on the 15th day of September, 1865, and the sanitary sergeants forthwith proceeded to enforce them. Those neighbourhoods which from experience were known to be most filthy and unhealthy were first visited, a copy of the bye-laws was posted in each house, and a familiar explanation of their provisions was given to each occupier of a tenement in it. In many instances the improvements which the sergeants suggested were carried out; in others they

were resisted, and the owners were accordingly summoned. The police magistrates, however, adjudged that registration of each of these houses as a public lodging-house was necessary before conviction for any sanitary deficiency could be obtained. The registration of these houses, which number about 9,000, caused considerable delay, and occupied the time of the staff for the first four months. I should mention that the visits of the officers were always most gratefully received by the poor tenants, and the allegations of the house-owners, as to their being intrusions on their privacy and liberty, were quite unfounded. During the first nine months the Act was in operation, 8,974 houses have been visited, 92,707 sanitary defects discovered, and the larger proportion of them corrected.

My esteemed friend Dr. MacCormack, of Belfast, the earnest sanitarian, regards the slip of wood which is nailed in to prevent the fall of the upper sash as "the most deadly instrument of destruction in the world," and there is not the slightest exaggeration in the statement. In an attic in this city I was last month called to see a family of nine persons, each of whom had only 170 cubic feet of space. The windows did not open down. The eldest child was removed for scrofulous disease to the Hospital for Incurables. The wages earned by the father, 10s. a-week, was their only support.

It is most gratifying that in the amended sanitary legislation, which the Government passed last session, the power of regulating tenement houses was extended to all Irish towns of over 5,000 in population, as well as the power to prevent over-crowding possessed by English Acts. The 35th section of the Sanitary Act, has been extended to Dublin, and the following regulations have been submitted to the Lord Lieutenant.

Regulations for houses, and parts of houses, let in lodgings or occupied by members of more than one family, within the Borough of Dublin, under the Sanitary Act, 1866, *sec.* 35, *others than Common Lodging Houses, within the povisions of the Common Lodging House Act*, 1851. *Made by the Nuisance Authority of the Borough of Dublin, the 4th day of December*, 1866.

"Every house or part of a house which is let in lodgings, or occupied by members of more than one family, shall be subject to the following regulations:

"1. That no greater number of persons shall occupy any room in any such house than can be accommodated with 300 cubic feet of space for each (for example, a room 10 feet high, 15 feet long, and 10 feet wide, contains 1,500 cubic feet of space, and may therefore accommodate 5 persons).

"2. That said authority, or any of its officers, may enter and inspect any such houses, or any apartments or appurtenances thereof, without let or hindrance, between the hours of 10 A.M. and 4 P.M., for the purpose of carrying into effect these regulations and the provisions of said Act, or in special cases at any other time, upon the signed requisition of the Chairman of the Committee of said authority, by vote of the Committee, and not otherwise, and may inspect and measure the dimensions of each room, and affix on the door thereof a description of the cubic contents of such room, in a form to be provided by such authority, and any removal or defacement of such certificate shall be deemed a breach of these regulations.

"3. That the owner of every such house shall have supplied thereto a properly-constructed ash-pit and privy, or water-closet, or privies or water-closets sufficient to accommodate the inhabitants thereof, and a properly-trapped house-drain communicating with the main sewer (if any within 100 feet from such house), and if no such main sewer then with a proper cess-pool; and shall cause such privies, water-closets, ash-pits, cess-pools, and house-drain to be kept cleansed and in proper repair; and shall also provide for each such house a sufficient supply of pure water; and keep the roof, external walls, and chimneys of such house in reasonable repair, impervious to wet; and shall cause each window of such house to be made capable of being opened from the top, or raised from the bottom, or otherwise opened to the extent of the half of each sash, and shall cause the entrance and hall, rooms, stair-cases, and lobbies thereof to be put and kept in good repair, and in a cleanly and ventilated state; and no room shall be let or used as a sleeping apartment unless it shall have at least one window; and all yards, halls, stair-cases, passages, and rooms,

not papered or oil painted, he shall cause to be lime-washed at least every six months. Within the provisions of this regulation, the word "owner" shall mean the person or persons who for the time being shall be in receipt of the rents of the lodgers or other occupiers of such premises.

"4. That no occupant residing in any such house, nor any other person, shall throw from any window or other opening to or upon any roof, shed, yard, passage, or street, any water, foul liquid, or other offensive matter or thing, or shall throw or drop same in or upon any common entrance, stair-case, lobby, street, or place, other than that provided for the proper deposit thereof, and every occupant or other person shall so use any requisite in or appurtenances to any such house as not to injure or break same, or render same ineffective, or put same out of order.

"5. For every offence against any of these regulations, or any portion thereof, the owners, occupiers, or other, the offender is hereby subjected to a penalty of not more than 40*s.* for any one offence, with an additional penalty not exceeding 20*s.* for every day during which a default in obeying such regulation may continue, and that such penalties shall be levied, recovered, and applied as is provided by said Act.

"6. That the said authority may, with the consent of the Lord Lieutenant in council, vary, alter, amend, add to, or rescind in part or in the whole any of the foregoing regulations as may from time to time be deemed expedient.

10*th January*, 1867. "H. MACLEAN, *Chairman.*"

"I confirm the above regulations.—ABERCORN."

Such a diagram as the following conveniently shows

the comparative size of a man, such a room of 1,500

cubic feet as above described, and the bulk of the air he hourly requires to breathe.

As children breathe so actively, and are so often attacked with infectious diseases, the same space should be allowed them as adults. The poverty of the occupants and the want of good house accommodation has precluded the adoption of a higher standard of space, the regulations under which I am sure would be disobeyed, and our efforts would consequently fall into contempt.

In Liverpool, there is a regulation that the floor shall be swept daily, and washed once a-week, and that the window shall be opened to the full for an hour in the forenoon and an hour in the afternoon.

It is advised that summonses be issued under 11 & 12 Vic., c. 43, as there is power to compel the attendance of witnesses, and in any amendments which may be made, it would be most desirable that a clause should be inserted, compelling the owner to give notice to the local authority when a case of any infectious disease arises.

In October last, His Excellency, through Sir Thomas Larcom, drew the attention of the Corporation to the fact that 1,648 houses, inhabited by 3,767 families, were unprovided with accommodation necessary for decency or health. Many of them have been since improved, but according to the bye-laws approved by His Exellency on the 10th of January, all the owners will be now compelled to amend this wretched state. The inspection of these lodging-houses is entrusted to eight sergeants and a superintendent of the metropolitan police, whose books constitute a most accurate record of the sanitary state of every one of their rooms. The Act for the inspection and regulation of lodging-houses in England, obtained by Lord Shaftesbury, was followed in 1851 by the Act to encourage the establishment of lodging-houses for the labouring classes, which provided that in towns of 10,000 inhabitants the local authority might borrow money from the Loan Commissioners for the purpose of building

wholesome dwellings for the labouring classes. The desire to improve the condition of the operative classes in English towns is so general, that I was surprised and disappointed to find that the Act has been only taken advantage of in one instance during the fifteen years it has existed. In that instance (Huddersfield) the success has been remarkable. In 1864 it provided for 40,928 nightly inmates, at a profit of £90 14*s.* 1*d.*; and in less than thirty years the establishment will be the property of the Town Council, principal and interest having been paid. This Act being thus a dead letter, the "Labouring Classes Dwellings Act" (passed last year through the efforts of Mr. Childers) extends the granting of loans for this purpose to public companies and to individuals who can offer fit security at 4 per cent., and repayable over forty years. A similar Act for Ireland possesses a valuable additional clause, providing that buildings, ruinous or dilapidated because of defect of title, may be sold in the Landed Estates Court. Mr. Mill, in speaking of the Act for legalising advances for the erection of labourers' dwellings, said:

"If I thought that such a measure would injure the independence of the working classes, or encourage their improvidence, I should strenuously oppose it; but the case seems to be one of a class of cases in which people require artificial help to enable them afterwards to help themselves. The taste for better house accommodation has still to be created, and until it is created, private speculation will not be able to find its account in supplying the improved accommodation."

Such Acts are perfect as permissive enactments; but, for reasons I will just now mention, I fear that, as in the case of the Act of 1851, the supineness of municipal bodies and landed proprietors will to a great extent render them nugatory.

In 1855, Sir W. Somerville and Mr. G. A. Hamilton obtained an Act which much facilitated the improvement of labourers' dwellings, by granting power to the land-

lord to recover possession, under the Summary Jurisdiction Act, of any tenement or cottage of a labourer which, having been previously provided with every sanitary appliance, had fallen into dilapidation. After some unsuccessful efforts, a statute, sanctioning the granting of loans on most favourable terms to landed proprietors for the erection of agricultural labourers' dwellings, was added; and the Commissioners of Public Works, to whom the management of the statute was intrusted, published regulations and specifications for the work. They also offered plans for the buildings, to which, however, the proprietors were not bound to adhere. No loan was to be granted for repair of old houses; the sum was to range between £200 and £1,000 for any one person; and no larger sum than £60 was granted for each cottage, one-fourth that sum being added by the landlord, who was also obliged to provide for each dwelling a properly-drained privy; ashpit, with puddled walls; and yard. Most glowing anticipations were entertained as to its effects in improving the wretched habitations of our peasantry; but I regret to say that they have been realised to a very inconsiderable extent. More than half the time of the Act has run (for it is to cease in 1870), yet, according to the last Report of the Commissioners, (1865) but nine loans, amounting to £4,900, have been sanctioned for dwellings completed. If £60, the usual loan, be divided into this, it may be supposed that about eighty cottages have been erected. Considering that there were in 1861 at least 200,000 cottages requiring to be rebuilt, and that the over-crowded state of labourers' dwellings is so notorious, it is much to be deplored that landed proprietors have not taken advantage of this admirable enactment in a degree at all adequate to the wants of their tenants. From the same report it appears that eighteen loans, amounting to £6,290, were sanctioned, but not proceeded with; and that sixteen, amounting to £8,800, had been about half completed.

A stroll over the Hill of Howth will practically convince any one of the advantages of the Act; in few parts of Connaught could more wretched hovels be discovered than existed here some years ago. Now their places are taken by several neat and wholesome dwellings for the labourers, which are set at highly remunerative rents. The cottages are kept in excellent order, and the same gratifying report may be made of many others of those erected under the Act.

Many counties—for example, Galway, Mayo, Leitrim, and Roscommon, or nine-tenths of the western province—which most sadly require improved dwellings, have never had a loan granted, no application, I presume, having been made by the owners of the soil. In the working of the Act there is a serious difficulty which, I trust, may be removed by future legislation. I can best explain it by an example. A landed proprietor in the South, having a large tract of unimproved land, let it to good tenants in small holdings, and granted long leases. His property has been vastly improved, and his tenants aided in the safest way. Instead of being rewarded, however, by the benefits of this Act, he is ineligible from receiving loans under it by the fact of having given leases; and, further, the tenants are incapacitated by the smallness of their holdings from seeking the responsibility of a loan of £200, the least to be advanced under the Commissioners' regulations.

Scotland has enjoyed a similar act, which has been largely taken advantage of by land-owners there. Until Mr. Childers' Act of last session landed proprietors in England had not similar privileges. Throughout this country there are a few large landed proprietors who have interested themselves in the improvement of their labourers' dwellings before this Act had been passed for Ireland; and the pretty and healthful cottages at Loughcrew, Clermont Park, Enniskerry, and Santry, occur to me in illustration. With regard to pecuniary return,

the Duke of Beaufort has most clearly shown, by precept and example, the duties of the proprietors of the land, and in many English towns four to five per cent. has been realized from newly-built humble dwellings. The Royal Agricultural Society has aided the good work by offering several gold and silver medals for the erection of the greatest number of newly-built labourers' cottages, or of improved cottages, in each province, or county, or district of its local branches. There is also the Leinster Challenge Cup, for the person who, during the year, shall have erected the greatest number of improved labourers' cottages in any part of Ireland. Stimulated by these rewards, some hundreds of cottages have been built and put in competition, as appears from the yearly reports of the Society.

With regard to the plans on which these dwellings should be constructed, I will not, of course, attempt to enter into details; but I exhibit these models from the Agricultural Museum of the Royal Dublin Society, representing some which have been erected; and these elevations and plans for a pair of labourers' cottages have been drawn by my brother, Mr. Dillon Mapother, C.E., of Louisville, U.S. They are adaptable for a small or large family by extension of the partitions; and, as all ornament is omitted, the expense would range between £60 and £75 each, every sanitary requisite being provided. These other plans have been just carried out on the premises of Messrs. Walpole and Webb, and at Bray, under the direction of Mr. C. Geoghegan, architect; and are intended to accommodate four families in each building. There are also on the table several valuable plans, which have been kindly lent to me by Mr. Barry, Commissioner of Fisheries, who has laboured longer and more energetically on the subject than any one with whom I am acquainted. A friend has informed me that cottages are made for a very small sum in France, by moulding in wooden shapes the scrapings from the

streets; but I fear that, like the mud cabins or iron houses, they would not allow permeation of air.

The essentials of a healthy dwelling are a dry, lightsome, and cheerful site, thorough airing, a full supply of pure water, such arrangements as shall prevent the decomposition of sewage in or near the house, and such staunchness as shall keep the ground floor, roof, and walls dry. The connexion between cholera and dampness I shall endeavour to prove when I come to speak on that subject. To ensure these conditions, the skill of the architect and builder should be, above all, expended. In London and other great cities the greatest advantages with respect to health, prosperity, and morality, have followed the erection of improved lodging-houses and family dwellings for the working classes. They have been in many instances highly remunerative, even up to 14 per cent. on the outlay. In other cases, where the noble benevolence of Mr. Peabody and others justified a greater expenditure than could be recouped in rents, the return has been as low as 3 per cent. Perhaps the Cromwell, Tower, Cobden, and Stanley buildings of the Industrial Tenement Company, which accommodate 200 families on the open staircase principle, may be taken as a medium. The profit from these has ranged from $6\frac{1}{2}$ to 9 per cent. Dr. Southwood Smith, from analysis of the death-rates of an unimproved and an improved block of buildings, states that,

"If the deaths in the whole of the metropolis had been at the same rate as in the Potteries, there would have died in London, in that year, 94,950 persons, whereas the actual deaths were 54,213; that is, there would have been a loss of upwards of 40,000 lives; and if the whole of the metropolis had been as healthy as the Metropolitan Buildings, Old Pancras-road, on an average of the three years, there would have been an annual saving of about 23,000 lives."

Much has been done in London towards providing fit dwellings for the humbler classes, and in many cases they have been fever-proof; but so great is the aggre-

gation of people reared in the country, and so vast the demolition by railway and other works, that overcrowding in the unimproved places is most excessive, and typhus is yearly increasing. Mr. Thomas Hughes was therefore justified in moving last session, in Committee on Railway Clauses Bill, that compensation should be given to tenement holders where more than fourteen houses in a parish have been removed; and that the Company should provide wholesome dwellings in place of those removed, and should have compulsory power of taking sites for the purpose. He is favourable to the system of providing dwellings out of the city, the railways to provide cheap trains. This principle has been largely adopted in France; and as far as it has been tried in London, it has succeeded. In Irish cities the condensation of population is not so great as to need this. In that most comprehensive and delightfully-written book, "The Homes of the Working Classes," by Mr. Hole, there are most interesting descriptions of Saltaire, Akroydon, the familistery at Guise, and the *Cités Ouvrières* of Mulhouse, where most admirable villages have been constructed for manufacturers' workmen. In Edinburgh, sixteen buildings, accommodating 847 families, have been erected, and they have all been pecuniarily successful.

In this city something in this direction at last has been done. The Industrial Tenements Company (Limited) has been established with a most influential directory, who have entered into the movement in a spirit of commercial enterprise, which alone can make the project remunerative, and on a scale adequate to the wants of our labouring population. From the prospectus I make the following extracts:

"This Company has been formed for the purpose of remedying an evil that exists in the city of Dublin, and of providing for the poor and labouring classes tenements in every respect superior to their present unhealthy and miserable dwellings.

"The Company propose to acquire, by purchase or lease, in the city of Dublin, old but substantial houses, which, owing to the decline of the locality in which they stand, can now be purchased or obtained on lease for long terms of years on advantageous terms, and by an economic outlay fit up these houses in tenements, providing each set with all sanitary requirements, thereby insuring to the labouring man the elements of health, cleanliness, and comfort. The Company also contemplate erecting improved dwellings on the principle adopted with such signal success in London, Edinburgh, and all the leading cities of Europe.

"There are at present 9,000 houses let in tenements throughout the city of Dublin, in very few of which (if any) is the sanitary condition of the occupant cared for, and in nearly all of which the common decencies of life are lost sight of, whilst in most cases the rents paid for these tenements are exorbitant for the accommodation afforded. From the working of the Improved Dwelling Companies in London, it has been found that the artizan and labouring classes are most punctual in the payment of their rents, and that every vacant tenement is eagerly sought after.

"The Company have ascertained that there are most suitable lots of houses in the city of Dublin, that can be obtained on advantageous terms.

"The preliminary expenses are confined to the actual outlay incidental to the formation of the Company, no promotion money or any payment of a like nature being sanctioned by the Articles of Association. The promoters have been induced to divide the capital into £10 shares, in the hope of inviting the artizan to invest his savings in the undertaking, and thus give him an additional incentive to promote the prosperity of the Company."

The financial success of improved dwellings erected in this city by Mr. Thomas Vance, Dr. Evory Kennedy, and Mr. Lindsay has been remarkable, and there are always many eager applicants for tenements when vacant, which facts augur well for the success of the company. The first stone of a block of buildings, to contain 120 rooms, was laid on December the 20th, before a most influential assembly, and the advantages which the company would produce in the way of example was eloquently dwelt on by several speakers. In the filthy dens in which townspeople now live, the honest arriving from the country are contaminated by mixing with the most degraded population.

The most important measure in regard to the subject ever introduced is that which Messrs. M'Cullagh Torrens, Locke, and Kinnaird brought in last February. It is entitled, "A Bill to provide better Dwellings for Artizans and Labourers," and applies to any borough or district in England to which the Public Health Act has been granted, or any place in the metropolis governed by a vestry. It provides that, upon application of twenty ratepayers of any town, parish, or district, or by resolution of the local authority, whenever the death-rate for three successive years shall have been over three in the hundred, the Home Secretary shall send an inspector to inquire into the sanitary state of any street, the number of persons living in it, the space and accommodation afforded, and the steps necessary to obtain sufficient healthful houses for the inhabitants. His report shall be laid before the local authority, and published within fourteen days; and, unless within a month the local authority shall prove to the Home Secretary that the improvements are not needed, he shall order them to be executed within a reasonable time. The dwellings to be constructed in lieu of those condemned shall be built with every sanitary accommodation, and so as to afford 350 cubic feet of space for every occupant. For these buildings the Loan Commissioners may advance money on the security of the rates at $3\frac{1}{2}$ per cent., to be repaid within thirty years by equal yearly instalments. The local authority is to have power to take land or sites for buildings, giving compensation to the owners, and is to manage the improved dwellings. From this latter responsibility they will be relieved after three years by a clause which Mr. Torrens has undertaken to insert. I think some clause, empowering the authorities in very condensed populations to convert the sites of the condemned houses into open spaces, is very desirable, the displaced

inmates to be provided for in suburban districts connected with a railway, at penny fares.

The compulsory principle on the occurrence of a fearful death-rate is a peculiar and valuable feature of this bill, and without it no considerable amount of improvement will be achieved in the dwellings of the industrial classes. This is conclusively shown by the facts I have before mentioned—namely, that the Loan Act in England has in fifteen years procured the building of one house, and the Irish Loan Act has in six years been instrumental in the building of some eighty cottages. As the former failure and the want of sanitary improvements in Irish towns is attributable to the apathy and mistaken parsimony of local authorities, I rejoice that in the Labouring Classes' Dwellings (Ireland) Act it is provided that loans may be also granted to public companies and estated individuals. So ill understood and so uncared for is the condition of the humbler classes in towns, that when that mild and permissive measure was passing through committee, it was characterized as "a monstrous bill" by a county member. Mr. Torrens' bill was referred to an admirably chosen select committee. Meanwhile, thirty-seven bodies have petitioned in favour of it, and two against. The Dublin Corporation and the Irish Medical Association have petitioned for its extension to Ireland. A joint committee of the Society of Arts and the Social Science Association also prepared a bill, entitled, "The Improvement of Dwellings for Labourers and Artizans Act, 1866," which Mr. C. Buxton was to have introduced. It gave compulsory powers to corporations to take land and build dwellings, the Home Secretary sanctioning the steps and the advance of loans for the purpose. It contained the usual selfish clause, "This Act shall not extend to Scotland or Ireland."

The Metropolis, Liverpool, Birmingham, and other large English towns possess local Acts for the complete

regulation of their streets and buildings, and the smaller towns are similarly provided for under the bye-laws of the Local Government Act, 1858. Under these powers, no house can be built unless its walls be of a certain thickness proportional to height, unless sufficient space be allotted for a yard, unless the lower story be efficiently drained, unless the roofs and chimneys be properly and safely constructed, and unless every habitable room be of a certain height. These provisions are placed under the supervision of the District Surveyor. Such a Bill for Dublin, on a very comprehensive scale, was prepared in 1863 with the aid of our Borough Engineer, but was never introduced. That it is required, a single example out of hundreds of ill-constructed, unimprovable buildings will show.

In Stephen's-place, which leads from Upper to Lower Mount-street, the houses are built back to back, without any thorough airing, yard, or privy; filth must be therefore cast on the roadway. The clergymen and inhabitants of that aristocratic neighbourhood have justly complained, but the remedy is not easy. The placing of a water-closet, which the poor would soon disarrange, is not safe in an unaired house; and, as the houses are owned by different persons, the Corporation can scarcely require that one shall be converted into a privy for the use of the occupiers of all the others, as we have done where one person owns several cottages. In other houses without yards or accommodation, filth has been accumulated to a vast extent in the cellars or back kitchen.

The Local Government Act is most useful with regard to new buildings, but does not interfere with those already erected, no matter how unwholesome, so that this addition would be desirable if the Act is extended to Ireland. With us, too, many places "to be let for building" are for years receptacles of filth and stagnant water as soon as they cease to till the ground. The owner should be forced to enclose and drain them.

In Glasgow many of the courts and houses are very ill-constructed, and so over-crowded are they as to allow but the average of three square yards to each person. An Act, however, for improvement, with compulsory power, passed last session almost unopposed, by which the ratepayers consent to tax themselves at 6*d.* in the £1 for five years, and 3*d.* for the ensuing ten years. It is provided that the improvements shall not go on so fast as to render houseless the present occupants, but that re-construction shall go on *pari passu* with demolition. In Liverpool, under the Sanitary Amendment Act, 226 houses in 189 of the ill-constructed blind courts for which that city is notorious, were removed or altered during last year. As many other great sanitary improvements have been achieved, the only circumstances which seem to account for its still excessive death-rate is the extreme condensation and dissolute habits of its population.

There should be also some efficient controlling authority for the laying out of towns and streets. While the rectangular form, with due regard to meteorological circumstances, so common in American cities, is most healthful, our towns, as will be seen from these Ordnance Index Maps, consist of angular streets of such devious courses as to appear rather the result of chance than design, and blind courts which are most insalubrious. One of the best means for ensuring healthiness in a town is the fit direction and good width of its streets. They should cross at right angles, and should not run due north and south, as the sun, being unshaded, would scorch one set at midday, and would never enliven those in the other direction at any time. As yet, scarcely any town in Ireland can boast of a wide street planted with trees.

In France, the dwellings of the operative classes, as well as all other sanitary matters, are directed by a special branch of the State, named "Commission de

Salubrité Publique ;" and a most effective machinery is organized, to see that all houses are built on proper plans, and are preserved in good order.

The English Poor Law Commissioners, in 1839, directed their assistants to make inquiry, whether a Building Act was required for the regulation of the houses of the poorer people ; and although they reported in favour of it, no general Act has been passed. The same deficiency exists in American legislation, and no more forcible explanation of the subject could be given than that which I quote from Dr. James, of the Council of Hygiene of New York, in his list of reforms :

"The passage of a building act prohibiting the present system of crowding and building houses on plans so injurious to health, the occupation of cellars for dwellings, and subjecting to certain restrictions the construction of courts and rear houses. For what calls most imperatively for reform, is the present construction of tenant-houses as regards light, ventilation, and every necessary comfort. Not only does the present system of over-crowding these pent-up and unventilated apartments, and the consequent necessity of inhaling an atmosphere loaded with carbonic acid gas, and the poisonous exhalations from human bodies, enervate the physical powers, and predispose to diseases of the worst type, but its demoralizing effects are fearful to contemplate, and instead of being the most attractive, home is often rendered the most uncomfortable and uninviting spot on earth. Hence it is that the husband spends his evenings at the neighbouring dram-shop, or the gambling-house, in search of comforts which his own fireside denies him. Hence it is that children reared amid these scenes of poverty, intemperance, and the whole train of their attendant evils, becoming daily more familiar with profanity and every species of wickedness, grow up willing and early victims to whatever vicious or criminal course may seem to them more attractive than their own miserable abodes. And hence I believe much of the vice, immorality, and crime of our city to be due to the construction, over-crowding, and mismanagement of tenant-houses. Efforts are from time to time made to relieve the condition of the poor, for which associations and individuals have contributed largely, all of which, however, is but a sprinkling of rain upon this great waste of human misery and destitution. The man of God who, in the exercise of his sacred office, frequents these abodes of poverty, in the hopes of directing the attention of some poor creature to the

one thing needful, too often encounters only that sullen or desponding indifference resulting from a long familiarity with everything that is cheerless and unattractive. If we would elevate the condition of these people, we must begin by relieving their social and domestic necessities, and furnishing them with habitations where they can enjoy sunshine and pure air, with abundant facilities for personal and domiciliary cleanliness. We then shall have taken the first step toward improving their moral as well as physical condition, and pointing them to the fulfilment of man's higher destiny. But the dark and cheerless rear tenement, with its unventilated apartments, its damp and dingy walls, and the attendant neglect of all sanitary measures, is wholly incompatible with man's social and moral nature, destroys all noble aspirations, ruins the most vigorous health, and opens wide the gate to mental, moral, physical, and spiritual death."

Some very conclusive arguments have been put forward that Public Health Committees of the Privy Councils of these kingdoms should be charged with the control of town authorities, as the Poor Law Boards are with that of the local guardians. As precautions are often neglected during freedom from epidemics, inspection is then needed to a greater degree than even when they are among us. But in many places it is only when the selfish fear of contagion creates a panic, or when the pestilence has already invaded, that active measures are taken, and in the latter case their usefulness is very doubtful.

I will sum up in a very few words what I hope for as necessary to improve the dwellings of the poor, and thereby raise immensely the standard of public health :

1st. The constitution of a complete controlling authority for directing local government and sanitary improvement.

2nd. The enactment of a comprehensive building code : the passing of local acts, being expensive, is often avoided.

3rd. That our sanitary laws should be compulsory in cases of flagrant neglect: the permission to act is still very generally construed as permission not to act.

4th. A generally diffused desire on the part of employers and land-owners to provide for the healthful wants of their dependents; and this will grow according as our nation prospers, and according as the masses are educated in the knowledge of the laws which regulate the well-being of their own bodies.

That the subject I have thus imperfectly submitted to you is closely connected with our prosperity, cannot be more forcibly expressed than in the words of the Devon Commissioners, which are painted in large letters over the entrance of the Agricultural Museum, Royal Dublin Society: "While the dwellings of the general body of the people are surrounded by the elements of disease, and are damp, cold, dirty, and comfortless within, so long will the country be destitute of even the semblance of general prosperity."

LECTURE XIII.

SEWERAGE—THE LIFFEY—UTILIZATION OF SEWAGE.

THE disposal of sewage while men live scattered over the face of an agricultural district is easy, as it is directly applicable for the utilization of the soil; but in the case of towns, the question is one of the most difficult problems of the day. It may be accomplished by water, or by removal in the recent or deodorized dry state, as practised in hot climates.

This latter mode, which in India is termed "conservancy," is not suited for a dense city population, as the frequent removal produces great nuisance, and the necessary deodorization is apt to be neglected. The best form for the collection of sewage on this plan is the earth closet patented by the Rev. Mr. Moule.

Much of the disease of towns in the middle ages was owing to the saturation of the ground and pollution of the streams with filth. In England attention was early called to the evil, for Richard II. in the fourteenth century made a law against the deposit of "annoyance, dung, intrails, nor any other ordure, into the ditches, rivers, waters, and other places, within or near any city, borough, or town, or the suburbs thereof; and if any do, he shall be called by writ before the chancellor, at his suit that will complain; and, if he be found guilty, he shall be punished after the discretion of the chancellor." Men and fishes know to their cost how this wise ordinance has been disobeyed.

The drainage of ancient Rome, and especially of the amphitheatres, has been most fully described by Mr. Cresy; and he shows that it was arranged upon principles deduced from the most profound study of mathematics and hydraulics, and was executed in a manner

with which no works of the present day can at all compare. It was thus that many thousands could remain in the Colosseum for days without injury to health.

Twenty years ago the drainage of Dublin was so imperfect that it would have been better to have had no sewerage at all—for instance, in Plunkett-street there was a sewer blind at both ends, a mighty cesspool or retort, in which are constantly brewing the fumes of putrefaction, to be distilled into every house by the branch drains or gulleys. Their flat-bottomed shape allowed of much escape. Other sewers of large size had only exit through smaller ones. These may seem examples of bad engineering, but the defective state of the the law rendered improvement impossible.

The main sewers are vastly improved, but house-drains and their badly-trapped openings are sources of extreme danger, as people do not realize the necessity of having them staunch. Dr. Evory Kennedy in his able address before the Royal Dublin Society, said:

"Let me request every man who hears this to walk down to his scullery, light a candle, and hold the flame of it directly over the opening leading from the sink-trough to the house-sewer; and if the flame of the candle be blown up perpendicularly by the rush of foul air, let him immediately have a water-valve interposed But let him recollect that if a rat-hole remain, keeping up a communication between his house and the general sewerage, he is still exposed to the influence of the poison."

A bubbling sound at the end of the drain is a sign of danger, indicating that it is choked at some point.—Servants often put solid bodies into house-drains, which at once stop them up. The street gulleys and water-valves are often obstructed, and the drains from them choked by the mud which is carelessly swept from the streets into them.

In many seaside places the sewers are not carried far enough towards the sea, and it is only at high tides that the refuse is flushed away. The advantage of such residences is thus often much lessened.

In a valuable paper on the utilization of the sewages of Dublin, which Ald. Gregg read before the Chemical Society, he said:

"No doubt the river Liffey was the great sewer of the old Celtic *Bally ath cliath*, or 'town of the ford of hurdles,' as, at the present day, we find it discharging the same office for modern Dublin. The ancient town was very subject to the caprices of Anna Liffey. At one time it would be swollen to such a degree as to overthrow houses, and at other times it would be completely dried up—as, for instance, in 1452, when a portion of the bed of the river, two miles in extent, was dried up. That tributary of the Liffey, the Poddle, was also employed as a sewer; for we find that, in the year 1587, Red Hugh O'Donnell escaped from the Bermingham Tower through the great sewer called the Poddle."

It discharges the drainage of about 450 acres of the city, together with two-thirds of the water diverted from the river Dodder by the weir at Templeogue. It is open for about two-thirds of its course in the city, but from New Row to the Liffey it is covered. The City Engineer lately reported:

"The arching has been built at different periods, some portions being very ancient, and for nearly the entire length it passes under houses and through private property, turning three mills in its course. This watercourse requires a very considerable sum to be annually expended upon it to maintain it in a safe state and free from obstructions; and owing to the numerous petty rights and interests which have been allowed to grow upon it, I see little chance of being able to make much improvement on this great drainage outlet."

I have a very strong impression that natural watercourses should not be converted into sewers, but that intercepting sewers should be made along them, and when I come to speak of cholera, I will give you reasons. Besides the ordinary passages for sewage, there ought to be at least in damp and reclaimed sites a system of land drainage, for, when subsoil water comes near the surface of ground, such as squares in cities, it interferes with vegetation, and generates damp, fogs, and malaria,

which have disappeared when the water level has been lowered by the use of drain tiles.

The towns of England are now better sewered than those of any other country, and this has been done mainly during the last quarter of a century, the Health of Towns Enquiries having led to such improvement. During the twelve years ending 1862, loans amounting to nearly four millions were advanced by the State for the purpose in England, and nearly an equal sum was afforded by municipal or private enterprise—not inclusive of three millions expended on the London intercepting sewers. Main sewers, on the average, cost a town £1 a head for every inhabitant, and about the same must be expended for house drainage, if it include the entire substitution of water-closets for cesspools.

Of this country I much regret that the same account cannot be given. I am aware that it is still a debateable question whether our rivers shall continue to be the main sewers of towns, or whether the sewage shall be utilized directly on the lands; but, in any case, there is need that the ground, water, and even atmosphere of our towns shall not be saturated with pernicious refuse. Under the Sewage Utilization Act of 1865, Poor Law guardians and town commissioners are empowered to construct sewers, and to borrow money, on the security of the rates for the purpose, from the Public Works Loan Commissioners. It remains to be seen whether, without any pressure from a central authority, and with the fear of increased rates before them, they will do so at all, and whether they will construct them in the efficient way they are constructed in England under the direction of the Local Government Office, for bad sewers are worse than no sewers at all. There was already an instance of the Public Works Loan Commissioners having refused to sanction a loan for the sewerage of a town, because the sum sought by the guardians was palpably insufficient for the purpose. It strikes me that the

Boards of Works in Ireland should be granted similar powers with respect to sewerage and water supply; and, perhaps, that department might be constituted a central authority, like the Local Government department in London, to which one interested in the health of this town, yet despairing of improvement as long as the ignorance, short-sighted parsimony, and insensibility of local bodies if uncontrolled, might apply.

Mr. Simon, the Medical Officer of the Privy Council, in his seventh report, forcibly observed: "With regard to these elementary necessities of health, I venture to submit that the time has now arrived when it ought not any longer to be discretional in a place whether the place shall be kept filthily or not. Powers sufficient for the local protection of the public health having first been universally conferred, it next, I submit, ought universally to be an obligation on the local authorities, that those powers be exercised in good faith, and with reasonable vigour and intelligence." In an admirable commentary on the Towns Improvement Act, Ireland, which was published in 1861, it is justly remarked: "The fact of a town being under the Improvement Act gives the grand jury a plausible reason for not interfering for a purpose apparently provided for under the municipal government; besides, grand juries must feel that the towns of any importance will one after another be withdrawn from their jurisdiction, and thus it seems foolish to improve to-day for people at the county's expense who may cease to-morrow to be contributors to the county funds."

It cannot be necessary to dilate on the necessity there exists for sewerage in all inhabited places, many authorities, and first, Dr. Southwood Smith, having demonstrated the advantages attendant upon this reform; he gives the following example: "There was a foul district in London, where the average annual death-rate

was from fifty to sixty in the thousand; the privies were turned into water-closets, and underground stoneware pipes were substituted for open drains, whereupon the mortality went down to thirteen in the thousand." The construction of a new main sewer and house drains in a neighbourhood has often been followed by a perceptible decrease of fever, as may be known by examining the books of many a general practitioner, who have, however, always shown disinterestedness with regard to sanitary reform.

To show that these sources of danger are often obscure, Dr. Druitt, President of the Health Officers' Association, gives the following instance of nuisance at a fashionable club:

"This house and the next had long been annoyed by a foul smell, which led the occupiers to seek the aid of the Inspector. After some search it was discovered that the outer and inner measurement of the premises did not agree; and on removing the paper from a part of the wall, an old door was discovered, which, when broken open, disclosed an old disused privy, with cesspool under it. This cesspool, which formerly received the sewage of both houses, was 16 ft. 6 in. deep, 6 ft. 6 in. long, and 4 ft. 6 in. wide, and contained ten cart-loads of soil. These were carted off, and the cavity filled with dry brick rubbish; the old saturated brickwork in the neighbourhood was also cut away and replaced by new; and here we may mention, as a practical fact, that brickwork once saturated with sewage seems incurable—stink and sweat it will, and the only remedy is to cut it away and build it afresh. In this case the remarkable ignorance and carelessness of workmen are well shown. An old cesspool left to save the trouble of removing it! a door papered up to hide it! The long number of years during which these houses were occupied as an hotel, and the degree to which the inmates must have suffered from stench is noticeable enough; and, as a crowning fact, it must be said that this old cesspool still received the overflow-pipe from a closet in a house in the next street, which kept its contents wet and stirred up, and which doubtless acted as a channel for the conveyance of gases into this house also."

One of the greatest difficulties in preserving the health

of the city which is now experienced, is the removal and disposal of the cesspool stuff. There are quite an insufficient number of persons employed in this way on their own account, and they store it up in yards in the densest and poorest parts of the city. During some months the farmers do not care to purchase it as manure. The endeavours of the Public Health Committee have, as yet, failed in getting contractors, who would remove it at once to the agricultural districts; and a hopper-barge to carry it to sea beyond risk of return is extremely expensive. The scavenging depôts of the Corporation have been much complained of, and the persistence of erysipelas in an hospital was assigned to the proximity of one of them.

Experiments on the best ways of preventing the escape of noxious gases from sewers, are being made on a great scale by Mr. Bazalgette. Four methods have been tried: 1st. Charcoal-ventilating grates, which have not been, as yet, satisfactory. 2nd. By joining flues to chimneys and furnace shafts. This method, if high chimneys were generally available, would probably succeed. 3rd. By ventilating through pipes carried to the tops of buildings, and the rain pipes generally suit. This plan was found very useful, but the occupiers of houses frequently objected to it.

In this city much bronchitis and other inflammatory diseases arise from the wet state of the flags during winter. If the owners of houses can be compelled to carry the water-spouts to the sewer, I am sure it would be a useful preventive measure. Power is given, in the Building Acts of other cities, to compel owners to bring the spouts under the flagways to the street channel. The condition of the streets is dwelt upon by the Registrar-General in his last annual report:

"London has acquired almost as much fame for that highly agglutinative compound, its mud, as for its fogs; and perhaps there

is more connexion than is generally supposed between them. It would be a humble but invaluable sanitary work if the streets were subject to a perfect system of purification—if they were frequently and thoroughly cleansed and dried. The attention of Boards of Works may be well directed to this end. The present expedient, by which householders who pay rates for parochial management are expected to clean the pavement in front of their houses, is unjust in principle and futile in practice. The whole width of thoroughfare, from frontage to frontage, should get the benefit of the same brooms and shovels. Old persons, whose avocations compel them to be much out of doors, in feebly urging their steps over filthy streets, waste much of that strength which should be husbanded for the employments by which they live. And how can poor people be expected to keep the inside of their houses free from damp and dirt, when all the adjacent exterior is a 'mud-ocean?' A good scavenger is a practical teacher of that cleanliness which is said to be next to godliness; and if the streets were well kept, the crowds who frequent them would read excellent plain sermons in the stones."

The fourth plan is the diluting of the sewage; but for this purpose a sufficient water-supply in London was not attainable. With respect to Dublin, I am strongly of opinion that as soon as the new abundant water supply renders the water of the present basins unnecessary for domestic purposes, it should be used to flush the sewers twice daily. I have found the remarkably small amount of two and one-third grains of organic matter per gallon in the Liffey water at the Metal-bridge, and the fact suggests to me the belief that the many large sewers, including the Poddle, which open above this point, do not efficiently carry down the refuse from the districts they are supposed to drain.

The means of cleansing and sewering Dublin in the seventeenth century is said to have been so deficient, that Swift's well-known lines, describing the effects of a city shower, would seem to have been applicable to the state of his own district:

> "Now from all parts the swelling kennels flow,
> And bear their trophies with them as they go;

Filth of all hues and odours seem to tell
What street they sailed from, by their sight or smell;
Sweepings from butchers' stalls, dung, guts, and blood,
Drowned puppies, stinking sprats, all drenched in mud,
Dead cats and turnip-tops come tumbling down the flood."

How imperfect was the sewerage of this city thirteen years ago will best appear from the report of a survey made in 1851 by our able Borough Engineer. He says:

"The levels of the sewers I found in general very badly laid out, particularly in the streets running east and west, which cannot have rapid falls; in many cases they were almost level, in others full of hollows up and down, and frequently could act little better than cesspools, requiring to be regularly cleaned out. In some of this class of sewers we found as much as four feet of solid deposit, rendering all house drainage impossible."

An instance was given some time ago of a closed court of sixteen small houses, which was drained by a sewer, 5 feet 6 inches high, and 3 feet wide, but in which 3 feet deep of solid filth collected, and blocked up the opening of the house-drains, rendering drainage impossible, and constituting a dangerous cesspool. A six-inch pipe-sewer, which acted perfectly, was substituted, at one-sixth the cost, £99 having been saved.

The house drainage of Dublin was even worse, from a mistaken idea among builders that it was necessary to have a drain twelve to eighteen inches square. The sides of these were built with bad rubble masonry, resting merely on the earth, and covered coarsely with flags, and they were brought under the basement (a course which should be always avoided when possible), with all kinds of angular turns, and without regard to fall. They frequently became stopped, and produced endless complaints, from noxious smells or flooding, and from the readiness with which rats made their way into the houses. Most of these evils have been remedied by six-inch or nine-inch pipes of good vitrified stoneware. The great essentials for effective house-drainage are, that the sewer

should have a good fall, be laid on a firm bed, and in such straight lines, with a gradual inclination from the highest to the lowest point, that it should be possible to see through each length as it is being constructed. When it is necessary to change the direction, regular curves, and not sharp bends or angles, or sudden changes of level, should be adopted. The sewer should be of such size and shape as to enable the water passing through it to scour out all deposit, and a complete flushing should be insisted on daily—or in winter every second day would suffice. The rain-water from the roof, if not tanked for washing, should be conducted to the sewers, for if allowed to soak into the ground, it is one of the cholera-producing conditions. And the material with which the sewer is constructed should be durable, impermeable to the fluid flowing through, which otherwise could soak into the earth, and cause dampness in the floors and foul and noxious effluvia. It is also essential that the sewer-pipes should be so carefully jointed as to prevent rats burrowing through. The sewer should never pass under the dwelling, as the greater heat of its atmosphere will draw the gases into it ; and all openings should be properly trapped for the same reason. There are many other principles with regard to really efficient and healthful arrangements for disposal of sewerage, which it is not my province to discuss ; but I can confidently refer to the admirable instructions for local authorities which were issued under the Local Government Act for towns, which are inspected by the inspecting engineers and medical officers appointed by the English Public Health Acts. Since Mr. Neville came into office, by the removal of sewering works from the hands of the Paving Commissioners to the Corporation, thirty miles of large and small sewers have been laid down in streets which never had sewers before ; also considerable lengths of old and decayed sewers have been taken up and new ones built in place of them ; and where the old sewers were found

sound, and their levels such as to permit of their being made available, they have been repaired, under-pinned, and had brick inverts placed in them, and their levels corrected, thus rendering them thoroughly effective. It is intended that those works shall be continued until every street in the city has a really effective main sewer. It is also proposed to remove all the old stone gully grates and substitute metal trapped gullies ; also to make side entrances into the sewers to facilitate getting into them for examination and repair, and render unnecessary the frequent breaking up of the streets. Sixty miles of old sewers have been also cleansed and repaired during the last twelve years, and means of drainage have been provided to at least 9,000 houses, As the Corporation has now the legal power of enforcing all householders to make drains when called on, the number will be soon far more numerous, and cesspools and foul privies and yards will be, I trust, a thing of the past ; for all who wished to preserve their health would be obliged to shun our city if the former conditions were continued.

The main sewers of Paris are very peculiar ; they are large enough to admit a man. Each house-owner pays three francs for the cleansing of the drain, and the sewer is emptied by a machine running on a tramway inside. Many English towns sewered by Mr. Rawlinson, of the Local Government Office, have adopted ventilating shafts with charcoal disinfectants for every main. The mouths of sewers should be trapped, for wind and the rising tide readily force back their contents ; from the want of this and from the drains opening above the low tidal edge, much of the coast round Dublin Bay is very fetid, especially as salt water promotes the decomposition of sewage.

I have only time to give you one instance of the influence of imperfect house drainage on the mortality of cities. Stockholm ought to be the most healthy city in Europe, for it is built on small islands, which secures abundant ventilation and cleansing. Owing to a bad

supply of water to houses, there is not a single house, with the exception of hotels, in which there is a water-closet. I have ascertained that it has the highest death-rate of any European city, despite the advantages which its position confers. The state of things could be improved, even without water supply, by the adoption of the *separateur* system, so common in the continental cities. A *separateur* means an iron box pierced with holes, which, receiving the night soil, allows the fluid part to escape, and the rest is deodorized by charcoal and removed in air-tight cases.

The old privy system is affectionately adhered to in some of the ancient institutions of our land. Thus, it is said that the heads of a college in one of our old universities have resisted the cleansing of that appurtenance for centuries, although tempted by adventurous treasure-seekers, who offered a round sum for chances.

If privies and ashpits must be retained, they may be made less noxious by being covered air-tight in every place, except a shaft which might lead to a neighbouring flue or to the roof of the building. When the rain is freely admitted decomposition is far more rapid; and when nothing but the ashes of the house are thrown into the refuse-place, and all slops cast into the sewer, much less injury results.

All the large sewers discharge into the Liffey, and among them is included the Poddle, which carries down the refuse of about 450 acres of the foulest district. This sewer is often dignified by the term "river," but it seems to me more to merit the description applied by Pope to the "Fleet Ditch":

> "The king of dykes, than whom no sluice of mud
> With deeper sable blots the silver flood."

It is a false economy to convert natural water-courses into sewers, for which nature never intended them. The sewage soaks out of them, and, as we shall see hereafter, cholera is more frequent along their lines than elsewhere.

I trust, however, we shall all live to see the Liffey "a silver flood," and if not it will not be for want of proposed plans.

The subject of the purification of the Liffey has attracted a great deal of attention of late years. The river was denounced in the House of Lords, by Lord St. Leonards, as "an absolute pestilence, in consequence of its being made the channel for the whole sewage of the city." The putrescent matter of the city emptied into a shallow river is tossed backwards and forwards by the flowing and ebbing of the tide; and finally, a portion of its solid matter being permanently deposited in its bed, is given off in pestiferous exhalations, which are wafted into every house and street near the river.

There is, no doubt, a greater proportion of diarrhœa and fever in these streets than in others distant from it, and cholera was frequent near to it in some places, but especially where other streams opened into it, or where the estuaries from it had been imperfectly filled up when the quay-walls were being built. This subject I will refer to in my lecture on cholera.

In the summer of 1858, the heat being very great, sulphuretted hydrogen was freely emitted from the Thames, by the decomposition of the sulphates in the salt water and the sewage matter from the city. Many boatmen, and other persons engaged along the river, suffered from sickness of stomach, headache, giddiness, red rash over the throat, &c. Diarrhœa was unusual, and seemed to relieve the other symptoms when it occurred.

An able writer in the *Medical Press* has advised that "barges should be placed under each outlet of a sewer, and provided with a filtering apparatus containing disinfecting materials, through which the sewage should be allowed to flow, the apparatus being so contrived as to retain the more solid part and the sediment of the sewage. Where the sewers are of a size permitting it, men could push accumulations through the sewers into the barges; in smaller sewers flushing by such means

as that invented by Sir John Gray some years ago could be adopted with much benefit." This will be possible when the new water supply arrives, for the former supply can be used for flushing. The contents of the sewers at their exit contain occasionally so little organic matter as to render it very probable that it is being accumulated high up along their course.

Various other remedies have been proposed from time to time by engineers, such as covering over the whole river, and constructing a magnificent Boulevard; running a railroad down the centre between solid walls, and dividing the stream into two portions, thereby increasing the scour; carrying the sewage by pipes from the sewers to the centre of the river; erecting flood-gates at Carlisle Bridge to be flushed at low tide. The stagnation of the water in the latter plan would be most objectionable; and the only efficient remedy is that which was first proposed by Nimmo—namely, the construction of intercepting sewers similar to those devised by Bazalgette in London, to pass along the river and cast the sewage into the sea, as far out as practicable. At present, at low water, wind blows up the sewers; and at high water, in spite of valves, the water enters; and at both times their fetid gases are forced into our houses; but if the discharging orifices were in the intercepting sewers this could not occur. No parsimonious spirit will prevail when it is remembered that the thousands expended will be repaid in scores of human lives and hundreds of sicknesses prevented. Between our unrivalled quays there will then course a pellucid and health-giving, instead of, as at present, a poisonous stream. Our able City Engineer, however, wisely advised the Corporation to postpone any action in these intercepting sewers till we had the advantage of knowing the results of the similar extensive plan in London devised by Mr. Bazalgette, by which the sewage is carried to Barking's Creek, fourteen miles below London Bridge, and being let in during the

first two hours of ebb tide, is carried off to sea. The distant outfall made the cost enormous. There is little doubt now of the efficiency of this plan, and I may mention the corroborative fact that large salmon are now taken in the river near Greenwich.

Mr. Bazalgette, the first of sewage engineers, being consulted reported to the following effect :—He first asserts that the separation of all sewage from the river is the only effectual way of purifying it, and gives his adherence to the utilization of sewage by pouring it over the land, all other methods having failed. In order therefore that it might be utilized, he proposed that the outfall shall be at the north side of the Bull, where it will be carried away completely, within an hour or two after high water. The sandy and waste lands from that point to Malahide, he considers most suitable for irrigation by sewage. The high level sewer which Mr. Neville proposed would be carried along the Ballybough and Clontarf roads to the Bull, and a pumping station would be necessary near Ballybough-bridge. The main sewer of the south side, he would advise, should be carried under Carlisle-bridge, as syphons are to be avoided.

Mr. Bazalgette says that if the sewage of the outlying districts is allowed to flow still into the Liffey, the nuisance will be kept up ; he therefore advises an extension of the municipal boundary, so as to include all the drainage, and establish a uniform rate for defraying the cost of the scheme. The sewage of the Rathmines and Pembroke townships, carried by the Swan and Dodder rivers, is cast back at flood-tides up the Liffey. This sewage should be taken in by extension of the Lower Mount-street sewer. In the same way extensions would be necessary to carry the sewage in the districts of the Poddle and Camac rivers. With regard to cost, he says :

" Calculating upon the data before me, I am of opinion that for the completion of the extended project herein recommended, a provision of £200,000 should be made. This sum will, at first

sight, appear a large increase upon the estimates before you, but it will more effectually accomplish the object you have in view; and taking the population of Dublin as the standard, it is nearly one-third cheaper than the cost of similar works in most English cities and towns." £1 per head has been the average.

When this plan was made known, a great local firm who had formed a company proposed to pay a rent of £2,000 a-year, and half the profits over fair interest, which would accrue from the utilization of the sewage. But for the present the matter has fallen through.

With regard to the source from which funds for such important works may come, Dr. Sigerson has translated the following apposite passage:

"*Pliny to Trajan*—The city of Amastris, sire, which is both fair and well adorned, has among its remarkable objects an exceedingly beautiful and very lengthy place, along which, the whole way, stretches what is called indeed a river, but which is, in fact, a very nasty sewer, filthy and disgusting to the sight, and pestilential by its most horrible odour. Hence, not less for health's sake than for adornment, it is of importance to cover it over, which will be done if you give your permission. We shall take care that money shall not be wanting to carry out this work, which is as great as it is necessary.

"*Trajan to Pliny*—It stands to reason, my very dear deputy, that this water should be covered, which flows through the city of Amastris, if, being uncovered, it is injurious to health. I am quite certain that, with your usual diligence, you will take care that money be not wanting to the work."

And he says:

"I beg to commend the foregoing correspondence to the Corporation of this modern Amastris. It is brief, but very satisfactory. Perhaps, as the present Chancellor of the Exchequer is a man of literary tastes, he may be induced to imitate this classic example."

However the funds are to be derived, the resulting injury is very great, and every well-wisher of Dublin must re-echo the hope of His Excellency the Lord Lieutenant, that soon the Liffey will be "compelled to waste its odoriferous sweetness literally upon desert air, and not upon the crowded streets and beautiful quays of your populous and increasing city."

There is no doubt that the time is approaching when, by a process of deodorization, sewage will be rendered innocuous, and will be applied to fertilize the land. The attention of the most able chemists and sanitary engineers is now fixed on the subject, as the pages of the Sewage Commissioners Reports and the *Journal of the Society of Arts* will testify. The daily amount of solid sewage is 3 ozs. and of fluid about 40 ozs. for each person, and this in a large community affords a vast deal of fertilizing matter, which, however, by the present system is so drenched with water, that there are but two or three pounds of solid to the ton of London sewage. Lime and carbon, such as our peat, are efficient, and not hurtful to plant-life, and the latter has been used for the destruction of the foul air of sewers, which too often is distilled into the houses. Some municipal bodies have become contractors for the removal of refuse, and in one year 144,414 tons of ash-pit stuff were sold in Birmingham to the neighbouring farmers; but taking into account all expenses, it must be acknowledged there was a loss of £6,000 to the borough. In the Liberty and other poorer parts of this city, such matters have been up to this stored up in nightmen's yards, to the great detriment of the inhabitants. The water of sewage has been the great difficulty, its weight and bulk making the cost of its carriage exceed its worth, and it has even been proposed to substitute a complete system of scavenging and immediate deodorization for sewerage, as such matters only become hurtful when putrefactive change begins. By some it has been deemed more advisable to use the fluid refuse to irrigate fields in the neighbourhood of large towns, and this plan has been carried out successfully by the Earl of Essex at Watford, at Croydon, Rugby, and for some years on a vast scale at Edinburgh. At the first-mentioned place the following experiment was made: two acres were irrigated by 60,000 gallons of refuse, which cost about 14*s.*, and two were left un-

irrigated. Both were sown with wheat and treated in every way identically, and there was a clear profit of £4 15s. more from the irrigated than the unirrigated acres. Any one who peruses the Reports of the Commissioners on Sewage of towns will be convinced that soon the rivers will be saved from pollution, and that the rule will be "the rain to the river, the sewage to the soil." At Carlisle, Mr. M'Dougal has leased the sewage, which he deodorize with his crude carbolic acid, or powder which contains it combined with lime; but his fields, spread with sewage, are said to have caused a severe outbreak of dysentery in the adjoining Lunatic Asylum.

The facts with regard to the utilization of sewage in various parts of Great Britain are so well detailed by Mr. Norwood, of the Dublin Corporation, who personally examined all of them, that I shall borrow largely from his report.

The present dry-weather sewage of North London is no less than 10,000,000 cubic feet per diem, but is expected to reach nearly 12,000,000 ere long; and the difficulty of providing the means and area for the utilization of such a quantity was very great. The embankment, which covers the enormous main outfall sewer which conveys the sewage from London, is ten feet in diameter, and near it there are farms wherein the sewage was utilized with success on grass fields, their luxuriant color contrasting with that of the surrounding herbage. Contrary to the opinion of Baron Liebig, it has been proved that the sands at Maplin, when irrigated with sewage, are most suitable for growing grass. In Lord Essex's park, at Watford, the land is irrigated, and not the slightest bad odor or injury to health has been traced. Mr. Norwood's account of the works at Croydon (which I also visited) is so able that I shall quote it entire.

"The town contains 17,500, and the parish itself nearly 30,000 inhabitants, and the sewage irrigation works are consequently

situate in the midst of a thickly-inhabited and most respectable district. The town itself is governed by a Local Board, who were compelled, by an injunction granted by Vice-Chancellor Wood in the year 1862, to cease fouling the river Wandle by permitting the sewage to flow thereinto, and to adopt the present system of irrigation. It appears that various plans had been tried for the deodorization and disposition of the sewage, apparently unsuccessfully, as repeated applications for injunctions had been made. Previously to 1862, the Board had applied the sewage, the daily amount of which reaches to from 800,000 to 1,000,000 gallons, to 15 and subsequently to 56 acres of land, but that being much too limited an area for the reception of so large a quantity of sewage, they, in obedience to the injunction, became tenants of about 250 acres of land, at £4 per acre, which is now let at £5 per acre, realising for the town a profit of some £250 per annum. The sewage is brought from the town in earthenware pipes, and so rapidly, that decomposition cannot take place, into two oblong uncovered settling ponds, lined with brick. The sewage flows in at one end through a rudely constructed screen, kept in its place by iron frames, which intercept the grosser parts of the sewage and mud, and thence out at the other end of the tank, and so by an open drain on the land. The sewage mud is cleared out of each tank once a fortnight, mixed with coal ashes or other refuse, and sold to the farmers of the neighbourhood at a cheap rate, 1*s.* to 1*s.* 6*d.* per ton. The proceeds of the rough filtration suffice, I am told, to pay for the cost of attendance, &c., so that the £250 per annum is clear profit, and would have been more, but that, at the time of the injunction, the Board were forced to take any land they could get, and make their arrangements hastily. On the occasion of my visit the atmosphere was particularly close, foggy, and heavy; and yet, in the immediate vicinity of the settling tanks there was no great smell, and certainly nothing more offensive than one would meet with in an ordinary farm-yard; but on the lands, which were actually under sewage as we walked along them, there was no unpleasant odour. The sewage is distributed over the lands through carrier drains by gravitation, into the outfall drains at the lower end of each of the fields, which are level, with a gentle slope to the river, and becomes brighter and brighter, according as it flows from field to field, until it is discharged by one main channel into the river Wandle as bright and clear as any river water, and betrays neither to the sight, taste, nor smell, the slightest indication of its having been once polluted. A considerable portion of the sewage passes, on an average, 2½ times over the land before being discharged into the river, in which fish abound.

"The sewage has been applied for some three or four years to the lands, which are of a loamy soil, somewhat sandy and resting on the chalk, and experience shows that they are getting richer each year. There are generally four crops of grass produced each year, which are sold at an average of £8 per crop per acre, and the first crop of sewage grass is ready usually a month earlier than other grass. No complaints whatever, either in warm or cold weather, have ever been made—since the introduction of the new system—of the sewage being a nuisance, and the river is now unpolluted; in fact, all persons seem to be of opinion that the sewage of Croydon is satisfactorily disposed of."

Of the works at South Norwood, Worthing, Tottenham (where the lime-drying process proved a great commercial failure), and at Rugby, a most interesting and minute account is given, and Mr. Norwood fully disbelieves the opinion so often quoted: "The experiments at Rugby succeeded in this, they transformed very good land into a swamp."

Mr. Norwood's account of the meadows about Edinburgh, where the sewage has been utilized for a century and a-half, is also favourable; so that from all his observations he is enabled to make the following conclusions:

"1st. The most effectual plan for cleansing rivers is to prevent by interception the influx of town sewage into them.—2nd. The cost of purification of rivers, and the profitable utilization of sewage, depend on the situation and local circumstances.—3rd. That the various patent processes for deodorizing and disinfecting sewage have proved to be expensive and unsatisfactory.—4th. That the best and cheapest deodorizer is the land, and the most economic method of disposing of the sewage is by applying it continuously to the land.—5th. That the value of sewage depends on local circumstances.—6th. That the various processes for solidifying sewage or forming artificial manures from it, have proved to be commercial failures.—7th. That the most economic method of the application of sewage to land is by gravitation and open carriers.—8th. That sewage can be applied to irrigation purposes if properly managed, without injury to the health or comfort of the inhabitants of the neighbourhood.—9th. That sewage when kept in motion either in the culverts, carriers, or on the fields, is inoffensive to the senses, and uninjurious to health."

At Hyde, Cheshire, 180 cottages are placed under a method similar to the French "poudrette" system, including the use of chemical agents, by the "Eureka Sanitary and Manure Company," and the Inspectors of Nuisances have reported most favourably of it; but I fear the profits will be doubtful. Daily or tri-weekly removal is usual on the Continent, and in India dry earth is used as an immediate deodorant, under the Rev. Mr. Moule's patent; but, indeed, there is nothing very novel in such a plan, for the directions of Moses (*Deuteronomy*, xxiii. 13) include all the principles of dry earth conservancy, as do also the sacred books of the Hindus.

Many parts of England are becoming so exhausted of plant-feeding constituents in the soil that the question of utilization of sewage is becoming one of national importance; for the vast capital which leaves the country to pay for corn and other foods, and manure, should be kept at home for other purposes. As Baron Liebig has shown:

"The employment of sewage in agriculture could make it possible to bring large tracts of land into cultivation which hitherto, owing to expense of tillage, had been laid waste and neglected. It is neither fantastic nor ridiculous to believe that without purchasing foreign manure, and by a judicious utilization of the sewage of towns and villages, England would be able to dispense with the importation of food from abroad."

The whole subject is exciting just now the greatest interest. Baron Liebig having stated that the manufacturers of artificial manures are "inimical to the utilization of sewage," a wordy warfare has arisen; and as the subject was one of three selected for discussion by the Public Health section of the Social Science Association at its congress at York in 1864, the meeting of that body was rendered of a much more lively description than ordinarily.

Mr. Rawlinson appealed to the fact that irrigation of lands had been in Egypt and India used from time im-

memorial; and that in Lombardy, for instance, to this day, some six millions of acres are subjected to the same process. He said that the fouling of rivers was a nuisance, but that the retention of filth about the houses had caused the appalling mortality by plague in our towns in the fifteenth and sixteenth centuries, and he gave many other reasons why a return to the cesspool system would be disastrous. They are a constant source of disease, and are expensive; for instance, in Manchester, where the Corporation undertakes the duty of emptying these receptacles, the annual expense is £20,000. He therefore strongly advocated the discharge of the sewage over land, and urged that this should be done over a small area, and by the cheapest possible works, especially those by gravitation. About 5,000 tons of sewage may be thrown yearly on each acre. Lord Robert Montagu, who had acted as Chairman of the Committee on the Utilization of Sewage, expressed his conviction, that the purification of rivers had now become a necessity, and described some rivers so foul that birds could walk over the scum on their surface, yet they were used as sources for drinking-water. The loss of fish is also serious. Three hundred families at the mouth of the river Dee alone were ruined, by the fouling of the stream and killing of the fish. The stock of artificial manures was, moreover, scanty and likely to be exhausted. After much further discussion the Association passed the following resolution:

"That this meeting regards the sewage of towns as of undoubted value as a fertilizer of the soil; and while recognizing the importance of getting rid of it as a source of disease from houses, is decidedly of opinion, that the true destination of sewage is the soil, and therefore strongly recommends a continuance of all efforts to divert it from rivers, and distribute it over the lands of the country."

The commercial aspects of the question I will now give you from a most valuable paper by Prof. Cameron, on the manurial value of sewages:

According to the results obtained by my last analysis, 100 tons of the sewage of Dublin contain the following fertilizing ingredients:

1st. In complete solution—

Nitrogen ..	16·50lb	@	£70	per ton	£0	10	3·75
Phosphoric acid ..	3·85	„	40	„	0	1	4·50
Salts of Potash ..	5·12	„	20	„	0	0	10·97
Salts of Soda ..	16·63	„	1	„	0	0	1·78
				Total,	£0	12	9·00

2nd. Mechanically suspended—

Nitrogen ..	2·48lb	@	£70	per ton	£0	1	6·60
Insoluble phosphate of lime ..	1·84	„	£8	„	0	0	1·57
Organic matter ..	14·00	„	10s.	„	0	0	0·75
				Total,	£0	1	8·92
				Grand Total,	£0	14	5·92

LECTURE XIV.

THE BURIAL OF THE DEAD—INTRAMURAL INTERMENT—REGULATIONS IN ENGLAND—CONDITION OF GRAVEYARDS IN IRELAND—BURIAL AND PROVIDENT SOCIETIES.

SHORTLY after the remarkable report on the Sanitary condition of the labouring population of England was presented by Mr. Chadwick, he was requested to undertake an inquiry into the state of cemeteries, especially those in towns, and great benefit resulted, a basis for legislation having been established. As such questions have not as yet been opened up in this country, I shall have to borrow freely from the results in the sister kingdom. Similar inquiries had been made in Germany, and Dr. Riecke concludes a lengthened report on the effects of putrid emanations as follows:

"The injurious effect of the exhalations from the decomposition in question upon the health and life of man is proved by a sufficient number of trustworthy facts. That this injurious influence is by no means constant, and depends on varying and not yet sufficiently explained circumstances. That this injurious influence is manifest in proportion to the degree of concentration of putrid emanations, especially in confined spaces; and in such cases of concentration the injurious influence is manifest in the production of asphyxia and the sudden and entire extinction of life. That, in a state less concentrated, putrid emanations produce various effects on the nerves of less importance, as fainting, nausea, head-ache, languor. These emanations, however, if their effect is often repeated, or if the emanations be long applied, produce nervous and putrid fevers; or impart to fevers which have arisen from other causes a typhoid or putrid character. Apparently they furnish the principal cause of the most developed form of typhus—that is to say, the plague. Besides the products of decomposition, the contagious material may also be active in the emanations arising from dead bodies."

Extramural burial is as old, however, as the time of the Romans, one of whose laws was "Hominem

mortuum in urbe ne sepelito neve urito." Mr. Chadwick adduced much evidence of a similar kind, especially as regards the hurtful effects upon the air and water in the vicinity of churchyards. He gives many instances of the bursting of lead-coffins, and of the gases emitted being so concentrated as to extinguish flame. He quotes extensively from French and German codes the rules with regard to interments in these countries, where sanitary regulations have been for so many years perfected. In some parts of Germany the opening of a well within 300 feet of a cemetery is prohibited.

I shall not detain you by citing Mr. Chadwick's statements with regard to the economical aspects of the practice of interment, but will bring before you some of his conclusions as to the effects on Public Health.

"That the emanations from human remains are of a nature to produce fatal disease, and to depress the general health of whosoever is exposed to them; and that interments in the vaults of churches, or in graveyards surrounded by inhabited houses, contribute to the mass of atmospheric and other impurities by which the general health and average duration of life of the inhabitants is diminished.

"That the places of burial in towns or crowded districts are usually destitute of proper seclusion or means for impressive religious service, and are exposed to desecrations revolting to the popular feelings; and that feelings of aversion are manifest in the increasing removals or abandonment of family vaults and places of burial, and the preference, often at increased expense, of interments in suburban cemeteries, which are better fitted to raise mental associations of greater quiet, respect, and security as places of repose.

"That the greatest injury done by emanations from decomposing remains of the dead to the health of the living of the labouring classes, in many populous districts, arises from the long retention of the body before interment in the single rooms in which families of those classes live and have their meals, and sleep, and where the deaths, in the greater number of instances, take place; and that closely successive deaths of members of the same family from the same disease, are very frequent amongst the labouring classes; and that, where the disease has not been occasioned by the emanations from the first dead body, as sometimes appears to

have been the case, or where the disease has either arisen from a common cause, or may have been communicated before death from the living person; the diseases are apparently rendered much more fatal by this practice of the retention of the dead body in the one living room previous to interment.

"That this practice of the prolonged retention of the dead in such crowded rooms, besides being physically injurious, is morally degrading and brutalizing."

A still larger inquiry was entered into in 1850 by the General Board of Health—which consisted of the late Earl of Carlisle, Lord Ashley (now Earl of Shaftesbury), Mr. Chadwick, and Dr. Southwood Smith—with the view of developing a general scheme for extramural sepulture in England. With regard to the escape of gases from dead bodies, Dr. Lyon Playfair, one of those who gave aid in the inquiry, says:

"I have examined various churchyards and burial-grounds for the purpose of ascertaining whether the layer of earth above the bodies is sufficient to absorb the putrid gases evolved. The slightest inspection shows that they are not thoroughly absorbed by the soil lying over the bodies. I know several churchyards from which most fetid smells are evolved; and gases with similar odour are emitted from the sides of sewers passing in the vicinity of churchyards, although they may be more than thirty feet from them. If these gases are thus evolved laterally, they must be equally emitted in an upward direction."

That great chemist calculated that nearly 3,000,000 cubic feet of noxious gases were annually emitted from the graveyards of London, which must either pollute the atmosphere or waters in the neighbourhood. Many instances have been recorded of deep graves filling so rapidly with poisonous gases that workmen going down have been destroyed.

Dr. Sutherland, of the Board of Health, reports as follows:

"I witnessed several outbreaks of cholera in the vicinity of graveyards, which left no doubt on my own mind as to the connexion between the disease itself and such local influences. Two instances occurred at Bristol, the particulars of which I reported at

the time to the General Board of Health. The results in both were most disastrous. Long-continued contact with the morbific influences proceeding from graveyards and other nuisances, appeared to have produced such a degree of susceptibility, that as soon as the epidemic touched the locality, the people fell before it. There is evidence to prove that a large fatality took place also during the last cholera epidemic in the neighbourhoods immediately adjoining the graveyards of the metropolis. It is not always easy to separate the effect of each specific cause of disease where a number co-operate, but after a most extensive experience, the evidence which has come before me has produced on my own mind an abiding conviction that the effect of many causes of unhealthiness, and that of churchyards amongst others, has been very much underrated. I have no doubt whatever that the burial-grounds, as at present constituted, are a continual source of pestilence—slow, perhaps, in its operation, and hence overlooked by ordinary observers. They are undermining the constitutional stamina of thousands of our town populations while people are denying that they have any injurious tendency; and it is only when some epidemic comes to try it like a touchstone, that the consequence of long antecedent neglect becomes so apparent as to rivet attention and excite alarm."

The condition of the metropolitan burial-grounds is fully described by Dr. Milroy, Mr. Ranger, and Mr. Bowie, and it appears in many instances to have been truly horrifying; and evidence is given by Dr. Waller Lewis of the dangers of interment under the floor or in vaults under the churches. Some injurious results may have induced the English Ecclesiastical Commissioners to condemn the practice as early as 1832. As an example of provincial towns, I will quote the description given by the reporter in Sheffield:

"Thirty years ago I was old enough to judge of the condition of the parish churchyard. At that time it was so full that it was not possible to inter a body a moderate depth without exhuming others which had been previously buried there; the same proceeding has taken place up to the present time. This churchyard was the sole place of interment for the inhabitants of Sheffield for 600 years, according to the chronicles of the town, and the burials still continue very numerous in it. I have no doubt that the superincumbent soil for six feet is composed almost entirely of decomposed human bodies. Towards Camp-lane the churchyard is six

feet above the street, and that side consists of stone, over and through which the drainage passes, by natural drainage, to the houses below, continuing its course below the streets (upon whose surface it sometimes shows itself, causing most noxious exhalations), down to the lower parts of the town, where it pollutes the springs from which the poorer class of inhabitants obtain their water. The churchyard is surrounded by houses. The effluvium is sometimes very offensive, and I am satisfied that the health of the inhabitants of the neighbourhood has suffered from it. I need only state that the vicarage, which stands on the upper side of the churchyard, has not been occupied by the present vicar of Sheffield for many years, on account of it not suiting his health. St. Paul's churchyard is surrounded entirely by houses. On one side the houses are built up close to the churchyard; on another side is a footpath; and on the other two sides it is bounded by streets. The soil is very retentive clay, and when a grave is opened, it is very shortly deluged with water, which water is the drainage from the surrounding graves, containing a large quantity of decomposing animal matter in solution. This is laded out with buckets, and poured upon the surface of the churchyard, where it speedily evaporates, creating a pestilential atmosphere in the neighbourhood. Until within the last twelve months this water of the churchyard drained across the street adjoining Norfolk-street into the houses, rendering them almost uninhabitable. Since that period a drain has been made down the centre of the street, which is a common sewer, into which all the drains from the private houses empty themselves. This churchyard is perfectly full, and no interment could take place without disturbing a previous one. The surface of the churchyard is, except on part of one side, considerably above the surrounding streets, and on the side of Norfolk-street, alluded to above, it is six feet above the level of the street."

It was not to be expected that unanimity would prevail with regard to the injury to the living from the dead being buried among them, and instances were brought forward of healthy persons who resided for years near churchyards; and it is surprising that the argument was not carried to the extent of asserting, that to bury dead within the houses of the survivors would not be dangerous. The report contains convincing evidence in favor of temporary reception, or mortuary houses, such as the following:

"When death takes place in these over-crowded rooms, the corpse is laid out and kept, until the period of interment, among the inmates of the room. It is sometimes stretched out on two chairs; or it occupies the only bed in the room. The inmates pursue their avocations round it; they eat beside it; the children play beside it; oftentimes the corpse is in an advanced state of putrefaction before it is removed for burial; offensive putrid effluvia are disengaged, and the spread of disease, in consequence, is no unfrequent occurrence. This is especially the case with infectious diseases.

"During epidemics all these evils are, of course, greatly aggravated; living rooms furnish the largest number of attacks and deaths, and there is the greatest risk of the dead being unduly retained among the living under the very circumstances where danger from such retention is the greatest. Instances are given in the report already cited of two and even three corpses lying in the house at the same time during the prevalence of the epidemic cholera of 1848-9."

In some German States the deposit of the dead in such places is compulsory; but great as the evils which result from the retention of the body in the wretched homes of the poor are, I never expect to see these reception-houses introduced into Ireland.

In the city of London, which extends over 218 acres, until intramural burial was made illegal, about 50,000 bodies were annually buried, an amount which would render the removal by oxidation impossible, and which should pollute the air and water of the place to a most pernicious degree.

The difficulty of awakening people to the perception of sanitary defects is clearly shown with regard to churchyards. The exhaustive report I have mentioned was circulated most extensively throughout England in 1843, yet, seven years afterwards, not the least improvement was perceptible, although a fierce epidemic of cholera had meanwhile been experienced.

With regard to the moral aspects of the question, Mr. Rawlinson, one of the numerous inspectors who investigated the condition of English churchyards, says:

" There is no object more painful to contemplate than a crowded churchyard, in such a state of neglect as the one at Hanley, here described. The earth is so mingled with human remains that its surface has been raised to an undue height above the adjoining ground; the subsoil is saturated with wet; the surface is trodden down by violent and rude feet; the refuse of the living in its most disgusting form is scattered over that site which ought to be sacred to the dead. And this painful description applies to a spot which ought to be held the most sacred, set apart for worship, and intended to be the abode of peace. A quiet, well-ordered cemetery is a place calculated to refine and soften the heart. The condition and desecration of a churchyard in such a way as has been described is most revolting, and calculated to shock every good feeling, and must be painful in the highest degree to the parishioners whose relations are buried there."

The publication of those reports, and the vast body of evidence collected, led to the passing of the Burial Act 13 and 14 Vic., cap. 52, which was amended subsequently in 1852, 1853, 1854, and 1857. The first of these forbids any interment within two miles of the metropolis.

The Burial Act Office, in connexion with the Home Office, was established for the purpose of amending the practice of interment throughout England, and for the giving of advice and directions when the opening of a new cemetery is contemplated. It was placed under the control of the late Mr. Grainger, the celebrated physiologist, and Dr. P. H. Holland, so well known from his numerous sanitary inquiries. Through the kindness of the latter gentleman, I am able to publish the forms which are issued from the office. When from local complaint or otherwise there is reason to think that any graveyard is in an unwholesome state, some of the following queries are is issued:

1st. Name of county.—2nd. Name of town.—3rd. Name of parish.—4th. Name of burial-ground.—5th. Area of burial-ground.—6th. Nature of soil.—7th. Date of opening for burial.—8th. Total annual number of interments for the last seven years, each year separately.—9th. Number of family vaults in the burial-ground.—10th. Average annual interments in family vaults.—

11th. Number of private family graves in burial-ground.—12th. Average annual interments in family graves.—13th. Usual depth of graves.—14. Area allotted to each grave.—15th. Number of bodies buried in a grave.—16. Amount of ground which has never hitherto been used for interments.—17th. Whether any burials within church or chapel; if so, state their average annual number.—18th. Whether any burials in vaults under church or chapel; if so, state their average annual number.—19th. Whether the ground was provided under any Act of Parliament; if so, cite the Act.

Systematic inspections are made without waiting for complaints, which even sadly-aggrieved persons are slow in making; and without such inspection I am most credibly informed that the most flagrant cases would not have been discovered.

When a new burial-ground is proposed, replies to the following queries are required to be sent to the office, and an inspector afterwards examines into all the circumstances of the locality:

1. What is the population of the district for which the ground is intended?—2. What has been the average number of deaths annually for a period of seven years; and how many interments per year are expected to take place?—3. What is the area of the proposed ground?—4. What is its distance from the nearest inhabited part of the burial district, from the mass of the population, and also from the remotest part of the district?—5. What is the distance from the nearest dwelling-house to the boundary of the ground?—6. Are there any, and how many dwellings within 100 yards of its boundary; and have the consents of the owners, lessees, and occupiers of such dwellings been obtained?—7. Are any persons known to object to the site proposed? if so, for what reasons?—8. Describe the existing means of access to the ground, and state whether it will be necessary to make any new road to it.—9. What is the nature of the soil, as ascertained by trial holes eight feet deep?—10. Is water found, and at what depth?—11. Can the ground be thoroughly drained; if so, will the drainage flow into any water now used, or likely to be used, for domestic purposes; and at what distance are the nearest pumps or wells from the boundary?—12. Has any other ground been proposed? if so, why has this been preferred?—13. What is the number on the tythe map, or other description by which the site may be clearly distinguished?—Send a plan or tracing of the ground

drawn to scale, with a sufficient description for its identification; having the position of the trial holes marked upon it (see query 9); and showing the situation of the ground with respect to the town, adjoining property, and points of the compass.—Send Surveyor's certificate, stating whether the ground can be thoroughly drained to the depth of seven feet at least; and as to the outlet for the drainage mentioned in query 11.

The following are the Regulations for Burial-Grounds provided under the English Acts.

"1. The burial-ground shall be effectually fenced, and if necessary underdrained to such a depth as will prevent water remaining in any grave or vault.

"2. The area to be used for graves shall be divided into grave-spaces, to be designated by convenient marks, so that the position of each may be readily determined, and a corresponding plan kept, on which each grave-space shall be shown.

"3. The grave-spaces for the burial of persons above 12 years of age shall be at least 9 feet by 4 feet, and those for the burial of children under 12 years of age 6 feet by 3 feet, or if preferred half the measurement of the adult grave-space, namely, 4½ feet by 4 feet.

"4. A register of graves shall be kept, in which the name, age, and date of burial in each shall be duly registered.

"5. No body shall be buried in any vault or walled-grave, unless the coffin be separately entombed in an air-tight manner; that is, by properly cemented stone or brick-work, which shall never be disturbed.

"6. One body only shall be buried in a grave at one time, unless the bodies be those of members of the same family.

"7. No unwalled grave shall be re-opened within 14 years after the burial of a person above 12 years of age, or within 8 years after the burial of a child under 12 years of age, unless to bury another member of the same family, in which case a layer of earth not less than one foot thick shall be left undisturbed above the previously buried coffin; but if, on re-opening any grave, the soil be found to be offensive, such soil shall not be disturbed, and in no case shall human remains be removed from the grave.

"8. No coffin shall be buried in any unwalled grave within 4 feet of the ordinary level of the ground, unless it contains the body of a child under 12 years, when it shall not be less than 3 feet below that level."

I will give you a short abstract of the Acts relating to the burial of the poor in Ireland. The Burial Ground

Act (Ireland) 19 & 20 Vict., cap. 98. In towns the municipal authority, and in other districts the guardians, are constituted the "Burial Board." The Lord Lieutenant in Council may restrain the opening of any new burial-ground, or close any existing one if necessary for protection of public health, and none shall be newly opened without his approval. No burial shall take place in such prohibited places under penalty of £10, without special approval of the Lord Lieutenant when satisfied that such burial is not injurious to the public health. No ground shall be appropriated for a new cemetery nearer than 100 yards from any dwelling-house, without the consent of the owner, lessee, and occupier. The Burial Board may take land and shall manage the new cemetery, and any one that shall have been closed.

The Lord Lieutenant in Council is empowered to make such rules "as may seem proper for the protection of the public health and the maintenance of public decency, and for the proper registry of interments."

The Public Works Loan Commissioners may advance loans (to the amount of £360,000 yearly for the United Kingdom) for the purposes of this Act, upon the security of the poor-rates in the case of unions, and the borough-rates in the case of towns, out of which funds expenses are likewise to be defrayed. Two clauses relating to the protection of cemeteries are incorporated from the English Cemeteries Act, 10 & 11 Vict., cap. 65.

The decomposition of human bodies placed in the earth in some soils is slow, so that to this day the bloody field of Culloden is recognized by the greenness of its grass; and if numbers of them were to be buried in close vicinity to large cities, the air and water should at last become poisoned. In our colonies great mortality has arisen from selecting disused graveyards as sites of barracks, of which the Raj Ghát Barracks, near Benares, affords a notable example; and Vicq d'Azyr tells us that an epidemic arose upon the opening up of the cemetery

at Auvergne. Extramural interment is therefore most necessary; and even then deep graves, and the provision of quickly-growing trees about them, should be always insisted on. If a body has to be kept unburied for such reasons as the arrival of friends, charcoal, or sawdust wet with carbolic acid, should be spread over the body in the coffin.

The air of cemeteries often contains twice as much carbonic acid as that of heathful places, and probably a like proportion of organic matter; sulphuretted hydrogen and ammoniacal compounds have been also detected, and in the air of vaults they are abundantly present. Those compounds are freely emitted in dissecting-rooms, and the diarrhœa which often attacks fresh students is owing to their influence. In the air of a thoroughly aired and cleanly dissecting-room, I found three times as much organic matter as in the air of an open space. Putrid vapours may be wafted for half-a-mile, as in the well-known instance of the Montfaucon knackery, for when the wind blew towards the St. Louis Hospital the stench was very great, and the health of the inmates was notably depressed.

In choosing a site for a new cemetery the main questions to consider are—1st. The soil. It must be sufficiently deep, for any superficial rock stratum would clearly render a place quite unsuitable. A dry, gravelly, or sandy earth, if not too open, but porous enough to let down air and rain, would seem to be the fittest, and a dense damp clay the least so. But all dampness should be removed by means of subsoil drainage, communicating with an outlet away from streams used for drinking. Any ground which is good for tillage would be good for a site for burial, as both animal decomposition and the growth of trees and vegetation, which have such salutary effects, will be rapid. Any soil devoid of vegetable matter is very unfit. In very moist places the body may be converted into a waxy

stuff known as adipocire, and some mummies found in this country were so preserved. What is known as "bog butter," is fat altered by the same conditions. In very dry places decomposition may be also incomplete, and the preservation of the bodies in St. Michan's Church, in this city, has been so accounted for. 2nd. It should be located so that the prevailing winds shall not blow the exhalations from it over the town. This is made the subject of a bye-law in Germany. The warm and humid south-westerly wind is particularly favourable to the putrefaction of such exhalations. 3rd. It is clearly desirable that a cemetery, should be easy of access, and that the approach to it should not be through the most crowded parts of the town. 4th. With regard to size of a cemetery, it may vary from one-fourth to one-half an acre per 1,000 of the population.

No inquiry has ever been made into the graveyards of Ireland, although they are nearly all intramural; many of them are over-crowded, and there is evidence that some are in such a condition as to pollute the water and air of the towns, with the effect of producing a palpable increase of epidemic disease. It seems desirable that there should be in Ireland, as well as in England, some independent officer who could judge of the suitability of any site for a cemetery in regard to soil, drainage, position with respect to prevailing winds, and other sanitary circumstances; and one of the highest authorities on the subject in England assures me that "power to appoint inspectors *quite removed from local influence* is indispensable to the successful working of a burial act. Local inspectors would, I am sure, be involved in interminable difficulties and disputes." The view is still more true with respect to inspectors for other sanitary purposes.

The Scotch Act gives power to any two members of a parochial board, or any ten ratepayers, to demand examination of the condition of any burial-ground.

Recently I gave evidence for the closing of a grave-

yard before the Privy Council, and very great overcrowding was proved. Interments had taken place in it for 1,200 years, and had so raised the level of the ground that it was as high as the second windows of some houses which immediately adjoined. Decomposing matter freely percolated through the boundary wall, and even into the cellars of the houses. Bad odors frequently pervaded the ground and the church, and the earth was dark, fetid, and greasy. It was proved that half-decayed bodies were often exposed, as from the number of interments some coffins had to be placed within a foot of the surface. The water of a neighbouring well was fearfully impure, especially from nitrates. Fever and cholera (during both epidemics) had raged around the neighbourhood of this graveyard.

I have visited the churchyards of very many Irish towns, and have found them usually in the very centre, often in the highest place—which, although it permits the diffusion of the emanations through the air, tends to pollute the wells. I know of one which is so low that the river from which the water-supply of some 30,000 or 40,000 people is derived overflows it in wet weather; and if this occurred during an epidemic, when many fresh bodies were interred, the worse consequences might result. When sketching the sanitary state of a few of our towns, I will mention some in which the graveyards seemed to me overcrowded, but I had no authority to examine the burial record, or to make any examination of the soil or surrounding waters. The boundary walls of many churchyards are so imperfect, that the bodies of infants are surreptitiously buried near the surface, whence, horrible to say, they have been uprooted by dogs.

Very many of the intramural cemeteries of our city have been closed, and the number of interments in the remainder are very few—a result for which we have to thank the founders of those well-placed and well-regulated cemeteries at Glasnevin and Mount Jerome.

I have not as yet specially examined into the circumstances of the graveyards, which are still open within the city; but from the nature of the soil and want of drainage in one of them, I think decomposition is retarded and some injury results, although the average interments for the last eight years have been but twenty-three annually. I would very gladly see the practice of interment in church vaults abandoned; and if it be not, it should be obligatory to employ air-tight metallic coffins, which have been lately brought into use in this kingdom, and with very great advantage. I show you the arrangement of this one, and you see that there is an opening in the lid after it is soldered down. A tube with a valve is connected with this opening, and through it the effluvia, which are discharged for some time between death and interment, can be conducted into the outer air. When the valve is closed, no gases can escape, and as the material is strong zinc no danger of bursting exists. In the case of deaths by dropsy and infectious diseases their use is very needful. A metallic coffin formerly cost £15—these new ones can be had for one-sixth that price. A very unscientific mode of destroying the gases in church vaults is often adopted—namely, the burning of pitch, which only substitutes one smell for another. In 1865 the vaults under seven of the churches in the parish of Marylebone were closed and purified under the direction of Dr. Whitmore. The disinfectants used were charcoal and dry earth, and Condy's fluid, and the spaces were filled up with concrete, and cemented brick-work. The expense amounted to £505, and that it was not misspent was shown by the fearfully noxious effects of the gases on the workmen engaged. Burial in the ground is declared by Prof. Parkes to be more unwholesome than either the sinking in the sea or burning of the remains of the dead; but so deeply-rooted is the feeling in favour of burial, with occasionally a very reprehensible pride, that it is likely to continue to be the usual method

for many generations. Incremation, or the burning of bodies, has been often advocated, but besides its being so contrary to long-established feelings, it is expensive and unless very carefully conducted is likely to leave much organic matter unconsumed, and a cloud of vapor may linger in the air near where the process has been conducted. If the body be *smother-burned*—that is, burned in such a way as that nought shall remain but a mass of charcoal, the result is advantageous, for all volatile matters have been dissipated, and a mass of animal charcoal, a powerful disinfectant, remains.

The funerals of the poor are generally conducted by aid of Friendly or Burial Societies, one-fourth of which are not registered, and nearly all are most unsatisfactory in their operation, as I learn from an able paper by Mr. Michael J. O'Shaughnessy, in the "Journal of the Statistical Society." He says:

"The majority of Friendly Societies see their end in twenty years. That is, the members find them bankrupt just as they begin most to need their assistance. But not only are these societies defective in their organisation; they are also shamefully wasteful in their management. Their meetings are almost always held at a public house, and a monthly contribution must generally be spent on beer. In fact, publicans are often the originators of these societies. We also find that charges for feasting, processions, banners, ribbons, aprons, and personal decorations are frequent. No wonder that during the last ten years about 10,000 Friendly Societies have failed, depriving hundreds of thousands of the labouring classes of provision for the future."

In 1864, Mr. Gladstone procured the Government Assurance and Annuity Act (27 & 28 Vic., cap. 43). The Postmaster-General has extended it to Ireland, and in no more useful way can the educated classes serve the poor than by recommending them to take advantage of this means of providing for sickness, the necessities of old age, or death among their families. As the State is not to derive profit from the system, the rates are very low.

Persons engaged in dangerous or unhealthy occupa-

tions, such as miners, butchers, innkeepers, or publicans, cannot assure at the ordinary rates. The premium may be paid even weekly. Mr. O'Shaughnessy selects the following illustrative cases :—A tradesman in his twenty-fifth year wishes to assure £50 at death. To effect this, he may pay once and for all £20, or annually till his death £1 0*s.* 5*d.* He may prefer to pay 2*s.* monthly, which will assure £53 at death. Again, it is surprising how soon a labourer in the decline of life wears out. Employers on a large scale must be aware of this, and nothing can then be more deplorable than their fate. Take one of this class, aged twenty-five, and willing to pay one shilling a week till his fifty-fifth year, when his physical powers will begin to decline. He becomes entitled to £1 a month from fifty-five till the end of his life. Female servants, accustomed during great part of their lives to a considerable degree of comfort, are generally the most destitute of all during their old age. At present, although most of their wants are provided for, their savings can hardly reach a sum sufficient to guarantee them against want when no longer fit for service. For this class the system of deferred annuities is eminently beneficial. For instance, a female servant in her twenty-fifth year, by paying £1 a quarter, may obtain when she has reached fifty an annuity for the rest of her life of about £13. If, as she advances in years, her wages increase, she can add by small payments to this provision. In England in the first twelvemonth 809 proposals have been accepted for insurance to the extent of £60,874, the annual premiums amounting to £1,924, exclusive of eighteen cases in which the premiums were received in a single payment. 501 of the insurers decided to pay their premiums yearly, 81 quarterly, 181 monthly, 3 fortnightly. Sixty-one proposals were declined. No death occurred in the first year. The Act has been extended to many of the larger Irish towns; but as yet scarcely any business has been done.

It may be said that the Irish workman could not spare the premium as well as his English brother; but it must be remembered that although his wages is lower, the prices of the necessaries of life are proportionately less. Prof. Leone Levi gives the yearly earnings of the British working classes as follows:

Ages.	England.	Scotland.	Ireland.	United Kingdom.
Males.	£	£	£	£
20 to 60 ..	217,300,000	2,900,000	43,500,000	289,800,000
Under 20..	15,900,000	2,400,000	4,000,000	22,300,000
Females.				
20 to 60 ..	59,500,000	8,950,000	13,000,000	81,450,000
Under 20..	18,800,000	2,350,000	3,600,000	24,750,000
	311,500,000	42,700,000	64,100,000	418,300,000

And £38,000,000 belonging to them is deposited in friendly societies.

LECTURE XV.

TOWN IMPROVEMENT—IRISH TOWNS.

I WILL introduce to-day's subject to you by an anecdote. Rigord, physician to Philip Augustus, relates that one day the king, walking to and fro in his audience chamber, went to look out of the window for recreation; some carriages of the citizens happened to pass at the moment, and the substance forming the street being stirred up by the wheels, emitted a stench so vile as to overpower Philip. Urged by this disgust, the king exerted himself to persuade the citizens to pave their streets with stone, and to remove nuisances from the fronts of the buildings, by which means he so improved his capital, that from being named "Lutetia," (*lutea a luti fætore*) on account of its dirtiness, it was thenceforth called "Paris," after the beautiful son of Priam.

However, in these modern days, pavement of streets by large stones, besides the dangers which it leads to from the slipping of horses, is found to be unwholesome by its retaining in the intervals between the stones organic matter which scavenging does not remove, but which rots, and in hot dry weather is thrown into dust and breathed by us. A macadamized road, with a good fall to the channel at each side, is the best kind of thoroughfare. The mud which is formed deodorizes organic matter, and it can be readily scavenged.

The thorough drainage of the site of a city is a matter of the greatest importance, as is also the way in which irregularities of surface are filled up. Unless good arrangements are made to drain the beds of the streams which originally coursed through the ground, the water, following immutable laws, will find its way to the places

lowest in the former topography, and there epidemics will rage most, even though there is no apparent dampness on the surface of the ground. In the lower part of a city, especially if reclaimed from sea or river, the hygrometer will show an average of twice the amount of moisture in the air than in the higher places, and it is probable that contagions are thus more readily carried or developed if moisture be necessary for that event. In such places rheumatism is always most prevalent, the emission of water by the skin being hindered. The bearing of these questions on cholera I will hereafter fully discuss.

The unhealthiness of manufacturing towns depends much on the murky atmosphere; the registrar of the greatest of them says:

"The unhealthiness of Manchester is due to its vitiated atmosphere; we have had an unusually dry season, and an extraordinary amount of sickness, with excessive mortality. Nothing but the constant rain we have in ordinary years makes a residence within its bounds tolerable. The air is well washed often, and we survive. No plant will live in Manchester without constant washing; the leaves become coated with soot, the stomata choked, and respiration ceases after a few hours. And that which destroys the life of a plant is breathed by the whole inhabitants of Manchester. This is the life-giving fluid on which they are to live and work. Let any one examine the lungs after death of a person who has been long resident in Manchester, and in the bronchial glands he will find a substance, inhaled soot, as black and thick as ink."

The rain which falls is never alkaline as in country places, but acid from the products of the coal. Sir R. Peel, who brought the subject most ably before the House of Commons last session, stated that 2,000,000 tons of coal were yearly burned in Manchester, a proportion four times over that of London. Mr. Hanbury, the brewer, saves £2,000 a year by a smoke-consuming apparatus. Besides careful stoking and appliances to burn the coal more thoroughly, which I told you of when speaking of air, I have now to tell you that the following projects are being seriously discussed: hori-

zontal flues opening into two or three vast chimneys out of the town; precipitation of the smoke by passing through water, and the carrying of the smoke, chimneys being abolished, into the ordinary sewers—a few great ventilating and discharging shafts being erected on high suburban places. The effect on the air, plants, and living beings of the smoke-begrimed manufacturing towns would be marvellous if the last-named scheme be feasible and be ever adopted.

The bad sanitary state of the towns in the Black Country, was most forcibly illustrated by some letters which were specially written for the *Birmingham Daily Post* in June last. Wolverhampton has still surface drainage, and therefore cellars are filled with foul water, wells are polluted, and cholera raged severely in 1832 and 1849; yet since then the dangerous localities have even deteriorated. The death-rate for the last decennium is 30·88.

"A large portion of the town of Dudley consists of ill-constructed courts, and lanes, and alleys, in which the houses are built back to back, so that there can be no thorough draught of air; in which foul privies and open soil-pits lie under bed-room windows; in which there is often nothing but a dilapidated channel or footpath of rough stones and bricks, and oftener no paving at all; in which surface drainage, garbage, and refuse lie decomposing in malarious puddles; and in which cholera, fever, and small-pox, whenever they visit the town, find most of their victims."

Bilston, is the epidemic centre of the district, one-fourth of the people in 1832 and 1849 having suffered from cholera. Along "the brook" nearly all were attacked. It has since been quite sealed up. The decennium 1851-60 showed a yearly death-rate of 30·53 in the thousand. As usual there is such another stream in Oldbury, with its consequences,

"There is a row of six houses lying off the brook at this point—that is, at the back of Park-street—and there is not a single resident in that row who, during the late dry weather, when the brook running low was at its filthiest, did not suffer an attack, more or

less severe, of bowel complaint. There, where the stream, laden with impurities, flows sullenly down between two blocks of crowded dwelling-houses, you may read of strong men stricken down by fever, and their unhealthy offspring cut off at the very threshhold of life; of the innate dirtiness of mankind, and the carelessness of their rulers; of that measureless ingratitude which turns the pleasantest of God's blessings into a withering, blasting curse."

In many of these large towns, villages 50 years ago, the population is extremely dense; but in one ward in New York, the population is condensed to the rate of 250,000 to the square mile, which is perhaps the highest in any city in the world.

Mr. Tom Taylor, the Secretary of the Local Government office, has most ably defined the relations which central and local authorities should have in regard to town improvement in the following terms:

"1. To confer powers for such improvement cheaply and effectually; to invest, with the legal character of 'towns,' areas of dense populations not having yet acquired a known and defined boundary, and to fuse into a consistent whole existing local acts and a general measure of town improvement. 2. When such powers are conferred, to forward generally the wise and efficient exercise of them by diffusing the light of a general experience, and by communicating the results of such special inquiries as the central department may be charged to make; by advising in cases of doubt or difficulty, and generally by assisting, but never superseding local efforts. 3. To protect posterity by examining and deciding upon applications for lease and mortgage rates. 4. To report to Parliament on the exercise of local powers. 5. To act as a court of appeal against local oppression in certain specified cases, and a court of mandamus in cases of local default."

I will, however, revert to this subject when analyzing our present sanitary laws.

In February, 1864, I had the honour of reading a short paper at the Statistical Society on the "Sanitary State of Dublin," in which I was compelled to assert that it was most unsatisfactory, because of the insufficient legal powers which then belonged to the Corporation, and because of the imperfect machinery which had

been organized to carry out the preventive powers which they did possess. In July, 1864, the "Dublin Improvement Acts Amendment Act" became law, and so ample were its provisions that it left little to be desired in the way of sanitary legislation, and it would have been the fault of the Corporation and its officers if most substantial benefits did not follow. Being desirous that other towns should share the blessings of so good a measure as the lodging house bye-laws of Dublin, I devoted a few leisure days in the autumn of 1865 to visiting them. Some I have recently revisited, and I regret that I could report in no more favourable terms. I have omitted those of my notes which refer to minute hygienic details.

The statistics with which I propose to illustrate the state of disease in each town are as follows:—1st. The death-rate, with which I have been favoured by the Registrar-General. In his inaugural address to the Statistical Society, in November, 1865, the Right Hon. Mr. Justice O'Hagan expressed his opinion that, notwithstanding the Registration Act, a large proportion of the deaths were unrecorded, and there is little doubt that the numbers of deaths in the towns I shall allude to are greater than these figures indicate. Compared, however, with the rates in rural districts they are striking indeed.

2nd. The number of cases of fever which had been treated in the hospital of each union, and those which were seen by the medical officer of each dispensary for the last seven years. I obtained these data from the Poor Law Commission returns; but as I have struck a yearly average on the assumption that one case of fever is treated at the patient's home for every two admitted into hospital (a ratio which, in some instances, I have found exact), the results are but approximations, and that admirably-worked department cannot be held responsible for them.

3rd. The proportion of inhabitants attacked with

cholera in the epidemics of 1832, 1849, and 1854. These proportions I have derived from the manuscript record of the late Prof. Barker, who for so long a period, in connexion with the Board of Health, cared for the public health of this country; from the report of the Commissioners of Health (1852); and from the Poor Law Reports of 1854-5. A few of these towns suffered in the epidemic of last year. Knowing that any general statement as to the unhealthiness of towns would be likely to meet merely with an apathetic assent, and as registration has only lately permitted the effects of faulty sanitary arrangements to be demonstrated, I will direct my remarks specially to each town, and I must beg forgiveness of the inhabitants if I should represent their localities in an unfavourable light. I will take them alphabetically in each province, but I may here mention that there is a great want of uniformity and codification in the municipal acts of our towns; Dublin, Cork, Kilkenny, Limerick, Derry, and Waterford, Belfast, Clonmel, Drogheda, Sligo and Wexford, are governed under the Reform Act, 1841; 18 are still regulated by the Act of Geo. IV; 71 towns are placed under the superior statute passed in 1854; and Galway Rathmines, and Pembroke are possessed of local acts.

LEINSTER.

Arklow (pop. 4,670) is a most neglected town, its cabins are usually back-to-back, and are filthier and smaller than any I have seen. In one 12 feet long, 5 broad, and slanting from 5 to 8 feet high, the woman who lived in it last autumn received "the Queen's reward," a proof that unwholesome circumstances do not check fecundity. Another poor creature was living in an old coach with a broken roof, planted by the edge of an open sewer. The streets in the "Fisheries" are as irregular as those of the "Claddagh," the ground is below high water mark, and immense pools of the most stinking

stuff accumulate between flood-tides. Many dirty water-courses intersect the town. The filthiest drain I have ever seen begins between a double row of some twenty houses, is open to the back-door of one of the houses in the main street, then passing under the floor to open into a main sewer which from its level can have no outfall.

Cholera was imported by the *Crystal Palace;* thirty yards from the house where the first man was attacked, there is an unprotected superficial well much below the level of the street; its water is used by all in the vicinity, and the ravages of the cholera were confined for some days to this place. By means of a refuge, an hospital inhabited by the good Sisters of Mercy, and by disinfecting the cabins, the disease was checked, with a low death-rate at the hospital, while up to the time of my visit every case kept at home had died. In one cabin where the man was dying, the wife said to me with quite an air of triumph, "Thank God, he's dying at home—I wouldn't let priest or doctor move him." In 1849, when the town was even filthier, it had the luck to escape infection. The noble family to whom the town belongs exhibited the greatest bravery and generosity during the epidemic. Long leases and sub-letting, it is stated, prevent improvement; but if Arklow could be transferred to English soil, where local government and building Acts prevail, it would not continue for six months to disgrace civilization.

Athlone (5,902) has suffered from every visitation of cholera. One-eighteenth of the people were attacked in 1849, and on 20th January, 1855, a severe outburst occurred. Some days after, an inspector of nuisances was appointed, who was to notice all owners of premises where nuisances existed, and, if found necessary, to summon them. The death-rate of the union has been 1 in 62. Fever epidemics have been always severely felt, over one-fourth of the people having suffered in that of 1818. The sewerage is very bad, the lanes filthy, the lodging-houses and cabins over-crowded, and the former

are not inspected. The water-supply is from pumps and superficial wells. The graveyard is in the centre of the town, very closely surrounded by dwellings. From the position of the town, divided by the Shannon, towards which both halves slope, an efficient system of sewerage might be readily constructed. The Commissioners have no local surveyor.

CHAPELIZOD (1,958), among other towns in the neighbourhood of the metropolis, loudly demands some local authority to prevent the ravages of fever and cholera when they become epidemic. I cannot more forcibly prove this statement than by quoting the following facts from the Poor Law Inspectors report:—The town, which had experienced severe attacks of cholera in 1832 and 1849, was visited again in October, 1854; and in February, 1855, another outbreak began, and within the week seventeen cases occurred. One case was that of "a factory girl, aged 18, who with seven others of about the same age, and a man, the father of two of the girls, lived and slept in a room not quite twelve feet square." The committee of management had held no meeting for 105 days before this last outbreak, although warned by the former one which had so recently occurred; and it was not until two days after the last case, the police sergeant informed the medical officer that steps would be taken for cleansing and whitewashing the houses where the disease had appeared, and for carrying into effect the provisions of the sanitary acts. I might easily multiply facts; but these, I think, are sufficient to show that in a town of nearly 2,000 inhabitants, some legal power to thin over-crowded rooms, such as that in which this poor girl existed, is called for, and that so tardy and inefficient a local authority as then existed should have been superseded.

KELLS (3,224). The death-rate of the district was 1 in 50. Fever is very prevalent, and is nearly three times as frequent in the Kells dispensary district as in the

whole union, the other districts being more rural. In 1818, one-third of the people were seized with fever. Cholera attacked 1 in 17 of the inhabitants in 1832, and 1 in 12 within seven weeks of 1849. Any one who examines the sanitary state of the town might predict that the death-rate and epidemic-rate would be thus lamentably high. The sewers are too large, made of rubble masonry, flagged on the bottom, and are very imperfect, most of them having gratings which emit the effluvia of the decomposing sewage, and the stench-traps which had been laid were, at the time of my visit, out of order. The lanes and the yards behind the houses were covered with the most noxious kind of filth, for there was no accommodation for most of the houses. The main sewers lead to the eastern end of the town, and open into gripes within twenty or thirty yards of the town, in which, as there was no current, the sewage was drying and putrefying. The river Blackwater, into which the sewage should be discharged, is not half-a-mile from the edge of the town. The water supply is by pumps, sunk, I was told, very superficially, two of them being in most dangerous proximity to the crowded churchyard—one within ten and the other within fifty yards of graves. Other pumps were in corners which were also used as the filth depôts of the town. The water was very bad in taste, and much complained of. The cabins were as ill-constructed, unaired, and dirty as could be seen in the remotest parts of this country. With regard to other towns, I must acknowledge that the corporate funds are insufficient for the adoption of such improvements; but Kells has an income of £750 a-year, exclusive of the borough-rate, which the commissioners have never levied. With such abundant funds, they should be surely called on to provide for the health and comfort of their constituents, when death, disease, and dirt so lamentably afflict their town. No medical man is connected with the Town Commission, nor do they

employ a surveyor. But one prosecution under any Sanitary Act took place in the entire county of Meath during 1864.

Longford (4,819). The death-rate of the union is 1 in 74. Cholera visited this town severely in 1832, 1849, and 1866, 1·17 of the inhabitants having been attacked in the second epidemic. The neighbouring town of Granard has wholly escaped, because it is high, not intersected by filthy streams, and possesses a good supply of water from deep wells, whereas those in Longford were more superficial, and as the river Camlin runs through the town, the poor people may have made use of its water contaminated with sewage. The commissioners have an inspector of nuisances, but filthy lanes of wretched cabins and unregulated lodging-houses abound. The registrar states that during the year 1865 there were severe epidemics of fever, scarlatina, and small-pox.

Maynooth (1,497) is but three below the population which empowers the adoption of the Towns Act. 231 cases of cholera occurred there in 1832, and 141 in 1849.

Navan (3,865). The district has had the very high death-rate of 1 in 48, and that of the entire union is thereby raised to 1 in 54, relatively one of the highest in Ireland, and startling when it is remembered how large a proportion of the deaths in this country are unrecorded. In the first cholera epidemic, 1 in 28 of the people suffered; but the town was very slightly attacked in 1849, although the neighbouring town, Kells, was so severely visited. Fever, which in the epidemic of 1818 attacked one-fourth of the people, is always very prevalent in Navan; and this can be no matter of surprise when one walks through the filthy lanes of hovels, many of which are lodging-houses, in which the town abounds. The sewers are too few, and, being untrapped, they do more harm than good. The Boyne and Black-

water course through the town, and would afford, as the town is hilly, natural aid to a system of drainage.

OLDCASTLE (979). The death-rate in this dispensary district has been 1 in 46, and in the entire union, which is remarkably rural, 1 in 73. About 1 in 78 of the entire union population yearly suffer from fever, which has been partially typhoid, or that variety most clearly produced by the want of sanitary arrangements. Cholera has always attacked the town with severity. Notwithstanding this lamentable state of public health in the town and surrounding district, it is unsewered and uncared for.

RATHCOOLE (442) was graphically described by the rector last year. He showed that most of the houses had no back yards, back doors, or windows at the back, and that they were unaired and abominably filthy in front. Zymotics, once introduced, raged. The rector's letter details the usual story of sub-letting, promises of amendment, apathy, interested committees, timid and ignorant nuisance officers, and *nothing done* after the pressure of an intelligent reporter and the dread of cholera had passed away.

RUSH (1,453) wants 47 of the required number, but if amalgamated with Lusk, which is only two and a-half miles distant, the combined population would be 2,092. The facts that 237 cases of cholera occurred in Rush in 1832, that fever is never absent, that sewers are most partial and untrapped, that many of the houses are remarkably ill constructed, and that the water-supply is principally by surface wells, into which a copious rainfall washes all kinds of filth, indicated that some sanitary authority was needed, and such was obtained by the Act of July last, but in a late visit I did not discover any amendment.

TULLAMORE (4,797). The death-rate has been 1 in 42 in the dispensary district, and 1 in 63 in the whole union. Both the former cholera epidemics visited Tul-

lamore, the first attacking 1 in 25, and the second 1 in 26 of the inhabitants. The rate of mortality on both occasions was about the greatest in Ireland—namely, 76 and 65 per cent. The Town Commission has no medical member, and has no nuisances officer. During an outbreak in 1854 they employed a person at a salary of 5*s*. a-week, a sum which could scarcely obtain the services of an intelligent or active man to inspect or cleanse the town. Not a single prosecution under any Sanitary Act has taken place in this town, or indeed in the entire county, during 1864.

ULSTER.

Ballyshannon (3,197). This town has always been subject to epidemics. In the year 1818 "almost every one was attacked" with fever, and in the cholera of 1832, 1 in 9 of the inhabitants suffered. While the steepness of the town and its proximity to the river would render it most easily drained, the sewerage is imperfect, and from the want of water-traps the stench in lanes is most pernicious. The cabins are most wretched and over-crowded, especially in the part named the Purt. The Town Commissioners do not employ an inspector of nuisances or local surveyor.

In Bangor (2,531) the order for electing a commission has been passed, but no steps have been taken, although no town in Ireland requires its admirable provisions more. 1 in 15 was attacked by cholera in 1832, and in 1849 the town was also severely visited. In November, 1857, fever burst out with such virulence that 25 cases occurred in a fortnight, five persons having been attacked in one house. Dr. Knox on that occasion described the houses as ill-ventilated and over-crowded, the drainage unsatisfactory; and these facts had been previously brought under notice without any material results.

Enniskillen (5,774). The death-rate of the union

is 1 in 72. One in 40 of the population was attacked by cholera in 1832; it wholly escaped in 1849, but suffered severely in 1854-55. There was then no permanent inspector, and Dr. Hill reported that no steps were being taken for cleansing the dwellings of the poor. Since then two persons are employed to prevent nuisances, and much of the improved health of the town might be attributed to this fact. As, however, but one prosecution took place in the county during 1864, and but four in 1865, under any sanitary act, we must suppose the inhabitants very obedient, or else the authorities very neglectful. The water-supply is by superficial wells and pumps, which give a very impure water, and partly from the river, into which the sewage of the town flows. The town is under the old imperfect Towns Act, 9 Geo. IV., cap. 82. The sewers are few and inefficient, and they discharge their effluvia by large open gratings here and there through the streets. I am happy to learn, however, that a guardian is agitating the construction of sewers under the Sewage Utilization Act; and as the town is steep and surrounded at all sides by the branches of the Erne, it could be readily and very perfectly drained. The town has corporate property amounting, I am informed, to £1,500 a-year, exclusive of the rates. The churchyard lies in the midst of the town, and, from its crowded state, must exercise a very pernicious influence.

NEWTOWNARDS (9,543) has never been spared by cholera, and fever is very prevalent. The registrar in September, 1864, described it as "dirty, unlighted, and unwatched at night;" but commissioners, three of whom are medical men, have been since elected, and the improvement is striking. The towns of Newtownards and Bangor are so close together that a commission governing both, with proper officers, could be readily elected, and even Donaghadee might be included. Some steps should be taken to stay the appalling mortality of the union, which is now 1 in 47, and to check the spread

of fever, which averages 1 in every 60 of the population yearly. These figures are explained by the fact that the union contains many towns in which sanitary matters are uncared for.

PORTAFERRY (1,960), another town in the same county, seems no better off. One-tenth of the inhabitants suffered from cholera in 1832, and an outburst of severe autumnal diarrhœa in 1857 invaded thirteen houses. A long drought had rendered the well water scanty and muddy. Cholera was carried into the town last October from Balbriggan.

MUNSTER.

CARRICK-ON-SUIR (5,059). The death-rate in the dispensary district attains the appalling figure of 1 in 34, and that of the entire union is 1 in 48. Fever attacks about 1 in every 31 annually, but for the year 1865 it has raged so alarmingly that about one-eleventh of the people were stricken down. In the fever epidemic of 1818, one-sixth of the people were attacked. The cholera in 1832 and 1849, respectively, attacked 1 in 40 and 1 in 23 of the townspeople. The graveyard is in the exact centre of the town, which is also the densest part. The Town Commission employs no surveyor, and appears to be a very apathetic body indeed, for in three consecutive reports in 1865 the registrar publicly complained that the sewers are bad and scanty, the houses are overcrowded, and the town is altogether the most dilapidated in Ireland. The registrar of a rural district near Carrick-on-Suir, Rathgormuck, justly complains, of this bad neighbour, from which fever has been imported into his district.

ENNIS (7,041). No less than 1 in 24 of the population of the dispensary district yearly suffer from fever, or about 1 in 62 of the people in the entire union. It escaped neither of the epidemics of cholera, 1 in 10 having been attacked in that of 1832, which created such a panic that

127 of the houses of business were closed; and 1 in 54 was seized in that of 1849. The death-rate of the entire union was 1 in 65, and of the dispensary district 1 in 42. Scarlatina broke out in a small filthy part of the town during the autumn of 1865, and in a couple of months produced 50 deaths. There is no method of removing sewage save by surface channels, and the water-supply is by pumps and superficial wells. The grave-yard is in the town and surrounded by houses. No medical man has a seat on the Town Commission, and no local surveyor seems to be employed. Dr. Crampton, the Government Inspector, in 1818 reported: "In the town of Ennis many of the poorer classes live in close dirty cellars, the streets narrow, and the population condensed within a small space. The town also had been remarkably dirty, and full of nuisances antecedent to the visitation of the epidemic"—a description which, I fear, is equally applicable at present.

In GLIN (999) in 1854 cholera broke out, and Dr. Geary reported that the houses were most filthy and over-crowded:

"In the main streets there are offensive open drains immediately behind the houses, and communicating from yard to yard, the contents being mixed in some points with the blood of animals slaughtered by butchers in their own houses. Few towns are better situated for drainage. At the village of Tarbert (three miles distant, and with 857 inhabitants), the very same state of neglected sanitary arrangements was observed; manure-heaps, cesspools, defective and obstructed drains and sewers running behind the houses; animals slaughtered in houses, and the blood on the floors in the very apartments used for cooking, eating, and sleeping in; pigs in the houses and rere yards; over-crowded apartments, and filthy collections of fetid water from underneath the paving, in immediate connexion with the police barracks."

Shortly after the date of this report the epidemic spread, and carried off, among others, the chairman of the board of guardians.

KILMALLOCK (1,393). The death-rate in the dispensary district for the year ending September, 1865,

attained the unequalled height of 1 in 28, and that of the whole union 1 in 60. Much of this mortality is due to fever, for on an average of seven years about 1 person in every 52 persons in the union is attacked with that disease each year; and in each of its six districts the rate has been as follows:—Kilmallock, 1 in 34; Bruff, 1 in 53; Hospital, 1 in 101; Kilfinane, 1 in 45; Charleville, 1 in 62; Bruree, 1 in 52. Cholera in 1832 attacked 1 in 12 of the inhabitants of Kilmallock. It is below the number for the Towns Act, but by amalgamation with a neighbouring town, as Charleville or Bruff, Commissioners might act for the two.

KILRUSH (4,593). The death-rate of the district is 1 in 50, and of the union, which is chiefly rural, 1 in 75. Fever attacks every year about 1 in 28. Cholera has on both the visitations spread with great rapidity and virulence, attacking respectively 1 in 24 and 1 in 17 of the townspeople. The graveyard is immediately at the edge of the town. The town is imperfectly sewered, and unsupplied by pure water; yet no steps have been taken to obtain the Towns Improvement Act, although the inhabitants are more than three times as many as the required number. But one prosecution under any Sanitary Act occurred during 1864 in the county of Clare.

KINSALE (4,850). The death-rate of the dispensary district is 1 in 51, and that of the entire union 1 in 64. In the first cholera epidemic 1 in 13 of the inhabitants were attacked, and one-sixth in that of 1849, Kinsale having suffered more than any other Irish town, except Gort and Ballinasloe, where nearly half the townspeople were stricken by the pestilence. The town a few years ago was unsewered, and the imperfect drains which now exist open into a large cesspool, which is, however, twice daily flushed by the sea. The noxious mud is left behind. Many of the houses are built on very sloping cut-away rock, which allows no perfect airing, or no draining whatever, as there are no sewers leading from them, and

percolation deep into the earth cannot occur. The water is derived either from filthy surface wells, or from wells near the overfilled cemeteries of the town. A new supply is about to be obtained, but from sources not at all above suspicion. In the epidemics of cholera, the low lying parts of the town, to which an ill-arranged system of sewerage would bring the sewage, suffered far more than the higher portions. No surveyor or inspector of nuisances was employed.

Macroom (3,289). The dispensary district, with the exception of this town, is very much a rural one, yet the death-rate has been 1 in 55. Cholera attacked the town severely in 1832, 1849, and 1854, and fever is stationary there, yet there is no town commission. Dr. Geary reporting in 1854 an unusually filthy state, says, "The want of water is much felt in the eastern side of the town, there being no pump, and the river being some distance away. Here, too, the absence of sewerage, or the defective character of that which has been attempted, tends to perpetuate the uncleanly habits which are found to exist. I am informed by the occupants of large and good-looking houses of business in the centre of the town, that they send all their house and night-soil to be deposited in the river at a late hour at night;" and people drink the water of this stream, both here and along its course to the Lee. Even the people along the banks of the latter great river would suffer from the sewage of Macroom, if forced by their own imperfect supply to use its water, until by some miles agitation and aëration it had been purified.

Miltown Malbay, high above the sea, permeated by the fresh Atlantic breezes, and which from its local advantages ought to be the healthiest town in Ireland, has been always severely visited by cholera, and during April, May, and June 1865, a disease still more preventible—namely, typhoid fever—has attacked between 55 and 60 of the villagers, who number but 1,330, the

cause being in every case traced to pollution of the water and of the air by want of sewerage in the neglected parts of the town, where water was also deficient. The medical officer duly reported these circumstances to the Poor Law guardians in April, 1865; during May and June the pestilence raged, and on the 15th of August, six weeks after it had ceased, this body first took action to improve the sanitary state of the town; but between April and September, about 150 cases of fever had occurred.

NEWMARKET (1,137). The sanitary state of this town is graphically described in Dr. Geary's report in 1854. Each house has a small yard, in which the house soil and manure float in very offensive water up to the kitchen door. Pigs are frequently kept in the yards, or even the houses themselves. Over-crowding seems to prevail, for in one house, not inappropriately named the "hulk," forty-six persons existed. Very many convicts have been reared in this abode, and the fact is not devoid of connexion with its sanitary state. Opposite the police barracks was found a dangerous collection of nuisances, drained by a sewer which passed in its course to the mill-pond under the floor of a house, to which there was attached a filthy yard for pigs, which were, however, also free of the house. A wretched man in cholera was found lying on the floor of this hovel, and when the sewer under the floor was opened, it was found choked with most offensive matter. Opposite this house it was customary to empty the night-soil of several houses, as there had been a drain; but as at this time it was choked, the filth floated down to the police barracks. Previous to Dr. Geary's visit, the medical officer reported a case of cholera, which was fatal, to the committee and guardians, verifying his statement by the evidence of two other physicians; yet the latter body postponed the consideration of the sanitary state of the town for a week. Sixty-six cases of cholera occurred in 1832 in this village, and it was severely attacked in 1849.

Tipperary (5,864). About 1 in every 62 persons of the entire union suffer annually from fever. Cholera did not spare the town either in 1832 or 1849, but attacked 1 in 27 of the people in the former year, and 1 in 38 in the latter. The death-rate of this town and the surrounding district reaches the high proportion of 1 in 39. The water-supply is by wells and pumps. The graveyard is in the town, surrounded by houses. There are Town Commissioners under the obsolete act, no medical man is among them, nor do they employ a local surveyor or inspector of nuisances. Mr. Charles Moore, M.P. for the county, on a recent public occasion, forcibly drew attention to the sanitary state of the town.

CONNAUGHT.

Boyle (3,098). This town was not spared in either of the cholera epidemics, and in 1818 one-fourth of its inhabitants were prostrated with fever. Typhus and typhoid fever are recorded as being frequent there this year. It is almost unsewered, surface channels filled with filth being in most of the streets; and, where there are sewers, the old-fashioned gratings which open from them emit all the effluvia. As the town is very steep, and the Shannon runs through its centre, sewers might be made most efficient. The Towns Act has not yet been adopted.

Carrick-on-Shannon (1,513). The assize town of Leitrim has not adopted the Towns Act. It is quite unsewered, wretched, and uncared-for in the extreme, and has a most suspicious water-supply. In 1818, the epidemic fever prostrated over one-third of the inhabitants; in 1832 cholera attacked 1 in 14, and so great was the panic that no one remained in the town except the doctor, the clergy, and the military. The death of a medical practitioner by cholera was recorded there during last August. The Nuisances Acts nor the Lodging-houses Acts do not seem to be practically in operation

in this county, for no prosecution under them is recorded in the "Judicial Statistics" for 1864.

CASTLEBAR (3,022). Few towns have suffered more from cholera than Castlebar, 1 in 18 and 1 in 27 having suffered in the two first epidemics. That pestilence broke out also in 1854. On the 29th and 30th of October five persons, four of whom lived in one house, had died, and three other cases were reported by the medical officer, who got together his dispensary committee. This sapient body resolved: "That at present there does not appear any decided case of Asiatic cholera," and consequently they do not appear to have taken any precautionary steps, for the epidemic spread. Since then Town Commissioners have been appointed, but the only clause of the Act which they thought necessary was that which empowers them to light the town, and they do not expend funds or employ officers for any sanitary purpose.

In LOUGHREA (3,072) the water-supply appears to be abominable, being derived from the lake into which the sewers, particularly those from the military and police barracks, empty. Seven cases of severe British cholera have occurred recently. The Commissioners have no medical man amongst them, and employ no sanitary officers, although the Marquis of Clanricarde contributes a sum equal to that yearly collected for improvement.

ROSCOMMON (2,619). The death-rate of the dispensary district is 1 in 38, being the highest I have noted, save those of Kilmallock and Carrick-on-Suir. So great is the town mortality that it raises that of the union, the other districts of which are very rural, to 1 in 58. Cholera produced great mortality in 1832 and 1849, and attacked respectively 1 in 30 and 1 in 26 of the townspeople. It was also introduced during last autumn. The Towns' Act has been adopted, but no medical man is connected with it. The town is in many places so ruinous as to merit the epithets in "Thom's Directory" of

"straggling, ill-built, and ill arranged—with miserable outlets." The sewerage is very imperfect, and one main sewer opens into a gripe along the poorhouse road, and within ten yards of it is the large pond from which many of the people derive their water-supply. The water of the town is scanty in summer, always impure, and has to my own knowledge produced attacks of diarrhœa.

In SLIGO (10,605) 1 in 43 yearly suffered from fever, on an average of seven years. In the cholera epidemic of 1832, this town suffered more than any other in Europe, 1,232 persons, or 1 in 12 of the inhabitants, were attacked, and the mortality for some days attained 100 daily. Again, in 1849, 1 in 27 suffered from that disease. The death-rate for the past year in the entire union was 1 in 54, and that of the dispensary district 1 in 47, and the sanitary state of the town affords an explanation of these sad facts. The sewers are few, and more for the conveyance of surface-water than sewage; they are furnished with mere gratings, which evolve the effluvia most freely. Scarcely such a thing as a water-closet is to be found. The Corporation has not adopted the water clauses of the Towns Act, and this greatest of sanitary requirements is derived from wells and pumps, which in badly-sewered and crowded towns are so subject to defilement. The water of the river is also used, and the impurities from the churchyard, which is but a few feet distant, percolate into it. A Water and Improvement Bill is now lodged, and I have given evidence in favour; but, like the loans for baths sanctioned in 1857, it may never be carried out as long as pressure from a central department is wanting. It is lamentable that some steps are not taken to close the graveyard, as well as those of very many other Irish towns. It is in the very midst of the town; its earth is dark, fetid, and overcharged with human remains, so that it cannot forward the decomposition of the bodies. So numerous have been the interments, that the surface has been

raised three or four feet above the level of the floor, obscuring the Abbey walls, which are so interesting to the archæologist. Many of the streets are narrow, ill-paved, and dirty. The Towns Act, 1854, has not been adopted; and as is quite usual in Irish towns, the Corporation contains no medical member, nor do they employ a surveyor or inspector of nuisances, or any analogous officer. The yearly funds, from rates and other property, in 1864 only amounted to £176—a sum preposterously inadequate to either the requirements or the wealth of the town, of which the rateable valuation is £17,895. Neither nuisances, the emission of smoke, want of sewers, offences under the Lodging-houses Acts, the sale of unsound food, or other sanitary offences seem to challege inquiry or prosecution, as Dr. Hancock records but three such cases in his "Judicial Statistics" during the year 1864.

It struck me that it would make my statements forcible if I was able to contrast with the foregoing towns one in the whole of which enlightened sanitary efforts had produced evident benefits; but I regret to say I could find none such in Ireland. The smaller towns in the agricultural counties in England, governed by good laws and fostered by liberal and resident proprietors, alone afford such encouragement. In Portlaw, indeed, cared for by a great manufacturer and patriot in deeds, one may see a mixture of the healthy and prosperous with the sickly and ruinous. Mr. Malcolmson owns 332 houses, which are clean and comfortable, and for the past year preventible diseases have been one-fourth less frequent in them than in the remaining 278 squalid houses of the town, and fever is much less frequent. But there is no commssion to sewer the town, or to cleanse or supply pure water to that part which is public, yet neglected, and from proximity to which the prosperous part suffers. The benevolent and able physician of the town writes to me that between the two classes of tenants

there is the strongest contrast in moral effect, in cleanliness, and in such small yet significant details as the increased culture of flowers.

The following 48 towns have adopted no Towns Act, although they possess the required population: Parsonstown, 5,401; Arklow, 4,760; Kilrush, 4,593; Portlaw, 3,852; Roscrea, 3,725; Macroom, 3,289; Boyle, 3,098; Mitchelstown, 2,922; Donaghadee, 2,671; Portarlington, 2,581; Skerries, 2,557; Ballinrobe, 2,506; Charleville, 2,468; Newcastle, 2,449; Bantry, 2,438; Holywood, 2,437; Tullow (a town which is especially faulty), 2,383; Buttevant, 2,732; Passage West, 2,288; Kanturk, 2,285; Listowel, 2,373; Dingle, 2,260; Whitehouse, 2,196; Gort, 2,097; Mountrath, 2,080; Dunmanway, 2,068; Legoneil, 1,968; Moate, 1,960; Portaferry, 1,960; Chapelizod, 1,958; Rathfriland, 1,916; Kilkee, 1,856; Tramore, 1,847; Cahirciveen, 1,802; Cappoquin, 1,774; Comber, 1,713; Castleisland, 1,702; Granard, 1,671; Edenderry, 1,661; Ballybay, 1,658; Askeaton, 1,637; Warrenpoint, 1,636; Tallow, 1,629; Ballycastle, 1,626; Ballaghadereen, 1,583; Graigue, 1,552 (ravaged by cholera last year); Donegal, 1,541; and Carrick-on-Shannon, 1,513.

By an amalgamation of neighbouring towns of some thousand inhabitants, many of which are uncared for; and by an expansion of the rateable area, so as to include the property of landowners who use the towns, or of absentees whose tenants use them, sufficient funds might be obtained to provide sewerage and water-supply, and to pay officers for their inspection and regulation.

The following 15 towns—Bandon, Cahir, Clonakilty, Fethard, Tralee, Youghal, Armagh, Downpatrick, Dungannon, Enniskillen, Lisburn, Monaghan, Moy, Omagh, and Strabane, many of them parliamentary boroughs, are under the old Act, 9 Geo. IV., cap. 82 (1828), which is very faulty and insufficient, not providing for water-supply, not giving separate rating powers for sewers in

special parts, and granting no borrowing powers for this purpose.

It is astonishing that these towns have not exchanged this old and cumbrous Act for the new one; but perhaps it is because houses under £5 valuation would then be rateable; an average of one-seventh of the town property as it is escapes taxation.

For reasons previously stated, the death-rates in the various unions and dispensary districts containing towns which I have alluded to, may not be in themselves very striking, but they become so when compared to those of purely rural unions. Thus, while the death-rate of all the districts I have described is 1 to 43, that of five rural unions from various parts of Ireland—Glenties, Bawnboy, Dunshaughlin, Ballinrobe, and Cahirciveen, containing together an equal population, is just half, or 1 in 86, and that of all Ireland is 1 in 61, or one-fourth less. In other countries the excess in mortality of civic over rural populations is not a fourth. Again, while on the average 1 in 52 is attacked with fever in dispensary districts which contain towns, but 1 in 281 of the people of the rural unions I have mentioned, or seven times as few, and 1 in 194 in all Ireland, suffer from that preventible disease. Sir William Wilde, in the sanitary part of the Census of 1841, brings out the same fact, for he shows that for that decennium the deaths by fever had been only half as many in the rural as in the civic population, even excluding all cases treated in hospitals. It must be also remembered that the death-rates and fever-rates of towns would be still higher if we had returns concerning the townspeople alone, and not of the entire dispensary district. However, the contrast is striking enough to convince me that a well-directed sanitary organization is capable of saving in Ireland thousands of lives yearly, and of protecting very many thousands from pestilence and the pauperism and misery which follow in its wake.

The death-rate for the population of all towns of over 2,000 inhabitants was, according to the Census Commissioners in 1841, nearly twice as high as that of rural populations, yet municipal authorities cannot comfort themselves with the belief that it was necessarily so. There is nothing in a well-regulated town to kill people faster than in the country; and even in London the rate of mortality has for some years fallen below that of all England. The causes of unhealthiness which may surround the peasant are under his own control; but the villager or citizen suffers through his careless neighbour, or his neglectful local authority, and the state should provide a remedy.

If I have shown that the sanitary state of Irish towns is bad, it is fit that I should propose some remedies, and those which I will detail in my two last lectures are in no way experimental, but have been tried and found perfectly effectual for many years in England. They would occasion considerable preliminary expenditure, but in the end would be really economical, for it has been often shown that sanitary improvements lessen public expenditure by affecting not only people's health, but their prosperity and contentedness.

LECTURE XVI.

OCCUPATIONS INJURIOUS TO HEALTH—PREVENTION OF ACCIDENTAL POISONING AND DROWNING.

PREVIOUS to the passing of the Factory Acts, the health of the workers was so bad and the effects of labor on children so notorious, that Commissioners were appointed in 1833 to enquire into the working of factories—their conclusion was as follows:

"That the excessive fatigue, privation of sleep, pain in various parts of the body, and swelling of the feet experienced by the young workers, coupled with the constant standing, the peculiar attitudes of the body, and the peculiar motions of the limbs, together with the elevated temperature and the impure atmosphere in which that labour is often carried on, do sometimes terminate in the production of serious permanent and irrecoverable diseases, appears to us to be established.

"From the whole of the evidence laid before us, we find—first, that the children employed in all the principal branches of manufacture throughout the kingdom work during the same number of hours as the adults; secondly, that the effects of labour during such hours are, in a great number of cases, permanent deterioration of the physical constitution, the production of disease wholly irremovable, and the partial or entire exclusion (by reason of excessive fatigue) from the means of obtaining adequate education and acquiring useful habits, or of profiting by those means when afforded."

Bodily deformities were very frequent from the constrained position they were forced to keep during work. Mr. Baker, the Inspector, now reports that the diminished time of labour has caused these evils to disappear.

"There are at the present moment, employed within the factories of the United Kingdom, 682,517 persons, compared with 354,684 in 1835. Of these 387,826 are females, compared with 167,696 in 1835; and 46,071 are children between eight and thirteen years of age, as compared with 56,455. There is thus a gross increase of workers of 92 per cent.: the increase of females

being 131 per cent., and nearly as many children as there were formerly; and yet all the diseases which were specific to factory labour in 1832 have as nearly as possible disappeared. We seldom or never now see a case of in-knee or of flat-foot: occasionally one of slight curvature of the spine, arising more from labour with poor food than from labour specifically. The factory leg is no more amongst us, except as an old man or woman limps by, to remind one of the fearful past, or of the more rational and social present. The faces of the people are ruddy, their forms are rounded, their very appearance is a joyous one; and although it is not attempted to be denied that, even, with the present hours of work, in weakly and scrofulous constitutions, factory labour, like any other kind of labour, may induce occasional deformity, yet so much carefulness is exercised by the certifying surgeons in passing only healthy children, that they are extremely rare, and the sufferers are never permitted to continue at work."

He adds also the testimony of several surgeons in great factory towns.

Among laws which are imperatively demanded for the United Kingdom stands first the extension of Factory Acts, or analogous measures, to employments carried on in workrooms of the clothing trades, or in the homes of the workers. The Children's Employment Commission, of which Dr. Grainger, so lately lost to the cause of philanthropy, was an active member, reports, "The hours of work during many months, often throughout the year, are excessive and destructive of health, whilst the sanitary condition of the workrooms is to the last degree defective. To these considerations it must be added that this question embraces the well-being of many thousands of women in the beginning and prime of life; the total number of milliners and dress-makers of all classes in the United Kingdom amounting to 370,218." My friend Mr. J. Edward White, the Assistant Commissioner, describes the workrooms of our seamstresses as follows:—"The general appearance of the houses in which these needlewomen live is very miserable." Speaking of manufacturing establishments he says, "Some of their rooms are so filled with workers without the admission of sufficient fresh air as to make

the air in them sensibly unpleasant, and some, as I noticed more particularly in Dublin, are in a rough and dirty state. One gloomy room, about 14 feet by 15 or 16 feet, rough measurement, though not low, with twenty females in it and the fireplace carefully blocked up, had a very close smell. In another factory the employer said that they had no need of fires, as so many sat together in each room." He was sparing of coals, while lavish of human health and life, through ignorance of the laws of these blessings, or perhaps from want of direct legislative interference. In one room in Stephen's-street twelve or more shirt-makers worked, and it was also used as the sleeping place for the employer, her son, two grown daughters, and grandchild. We have reason to be thankful that in Mr. White's report there is little evidence of that moral degradation and educational darkness which is shown to prevail in some other parts of the United Kingdom, and which so horrified the public when comments upon and extracts from this valuable Blue Book appeared in the public press. From some statistics, appended by Dr. Letheby, it appears that more than twice as many deaths by consumption and fever (of all diseases the most accurate sanitary tests) occur among needlewomen than among other females of corresponding ages in the City of London, and that, while the mean age at death of the latter is 29·6, that of the former is but 24·7.

Since the reports of the Commission have appeared, it has been generally conceded that laws are required for the regulation of workrooms similar to those which have done much good in other factories; and in no part of the kingdom are they more necessary than in our northern muslin and linen-making towns, where there is an excessive mortality by consumption.

To omit moral and educational considerations, we must conclude that the general physical result of the overcrowding, want of fresh air, irregular and scanty

meals, and extreme length of the working hours, upon most of the young persons employed in those trades not yet regulated by law, are great proclivity to all diseases without power to bear up against them, and especial liability to zymotic complaints and consumption.

The Clerk of this Commission has said: "If all the measures it contemplates are allowed to become law, it will have raised the manufacturing children of England from dirt to cleanliness, from disease to health, from immorality to purity, from gross ignorance to moderate intelligence, and from the want of knowledge of the existence of a God to an acquaintance at least with the fundamental doctrines of Christianity, at the cost, to each member of the community, of about a quarter of a farthing."

At the Social Science Congress at Sheffield, it was resolved, "That in the opinion of this section the most practicable way of carrying out the recommendations of the Children's Employment Commission would be to enable the Privy Council to extend factory legislation to different trades where women and young persons under 18 are employed, with such appropriate regulations as may be suited to each trade. That the rate of mortality in every trade where there is alleged excessive mortality should be calculated for each large town and district by the Registrar-General and published."

Among all the trades which are carried on in this city, I do not think there is one in which the rules of health are more violated than tailoring. From a large experience of out-patients at dispensaries, I may say that there is no more unhealthy class. They are accustomed to work at their sedentary employment for twelve or more hours daily, in the closest and most ill-ventilated rooms, and they are thus urged on to crave for the stimulus which drink gives them with so heavy a penalty. Consumption, diseased liver, shattered nervous system, and other ills which intemperance produces, are most

frequent among tailors. We hear very much of shop improvements, but they are usually confined to the fronts, the rooms in which the journeymen work being most disease producing. There are some large establishments where more reasonable care is taken of those employed, and Lord Carlisle perhaps never performed a more useful social act than that of inspecting one of these well-organized buildings, yet for so doing ridicule was cast upon him by those who are incapable of understanding the benefit of efforts to improve the condition of the working classes. Dr. E. Smith reported for the English Government as follows, on tailors' workrooms:

"They vary much in their sanitary conditions, but almost universally are over crowded and ill-ventilated, and in a high degree unfavourable to health. Some are found underground, either in the basement of a house, or built like a large kennel in a small enclosed yard, and are such that no domestic servant would inhabit. In exceedingly few shops have there been any attempts at ventilation, except through the windows placed at the sides or in the roof; but in some, air-bricks have been inserted into the wall, or a tube, with perforated zinc placed in its upper edge, and communicating by the end with the outer air, passes through the room, or tubes of various kinds pass perpendicularly from the floor to the roof. When the gas is lit, as during the day-time in foggy days, and at night during the winter, the heat increases to 80 degrees and even to upwards of 90 degrees, causing profuse perspiration, and condensation of vapour upon the panes of glass, so that it runs down in streams or drops from the roof, and the operatives are compelled to keep some windows open, at whatever risk to themselves of taking cold. The cubic space in these ill-ventilated rooms allowed to each operative and the gas-light is in the average only 156 feet per man.

As might be expected, their death rate is one-third greater than that of agricultural labourers of similar ages. The *Times*, commenting on these facts, forcibly remarked:

"These facts are parallel to the observation so often made in war, that the loss by sickness, which is frequently due to a neglect of well-known sanitary laws, is greater than that due to the direct destruction by shot and shell. In both cases the cause and the excuse are the same. The heat of the struggle, the pressing

necessities of the campaign, the close competition, are said to leave neither time nor money to be over particular about the means so long as the end is gained. But even in war we are gradually getting to acknowledge that this recklessness is disadvantageous as well as cruel, and we may be certain that the selfishness which leaves such dangers unaltered in the comparatively cool struggle of civilized life defeats its own ends. Yet it seems that human nature is too short-sighted or too inerradicably selfish to remove these sufferings of its own accord; and here, too, the medical officer sees no resource but in the interference of the Legislature."

The baker is even subjected to greater ills than the tailor. His place of work is on a basement story, where the heat of the oven and gas make the atmosphere unendurable, save to those whose perception of such evils is dulled by habit. The drainage is often out of order, and the air is still further irritating by the particles of dust and flour it contains. In this wretched condition he is kept from nine in the evening to five the next morning, or much longer towards the end of the week, and until the Bakehouse Regulation Act, 1863, was passed, even Sunday was no holiday to him. In London, we are told by the highest medical statist living, Dr. Guy, the result of these conditions, for 31 per cent. of the bakers are more or less consumptive. Professor Max Muller said to Mr. Tremenheere, to whom the country is indebted for the Act: "Your report has made me feel that I have been hitherto consuming at the rate of at least one baker a year in solution." The great relief was only granted in Belfast, where Mr. Hughes, a master baker, single-handed, carried on the system of day work; he has carried it out ever since (with one slight exception, that of beginning on Monday morning immediately after twelve o'clock on Sunday night), having realized a large fortune, and has one of the largest baking establishments in Ireland. He is an ardent advocate of the day system; and if protection of the Sunday's rest were extended by law to five A.M. on the Monday morning, he would be delighted to adopt

the Scotch system of twelve hours, from five A.M. till five P.M. The Report of the Committee states:

"In Limerick, where the grievances of the journeymen are demonstrated to be excessive, the movement has been defeated by the opposition of the master bakers; the miller bakers being the greate t opponents. The example of Limerick led to a retrogression in Ennis and Tipperary. In Cork, where the strongest possible demonstration of public feeling took place, the masters, by exercising their power of turning the men out of employment, have defeated the movement. In Dublin the master bakers have offered the most determined opposition to the movement, and, by discountenancing as much as possible the journeymen promoting it, have succeeded in leading the men into acquiescence in Sunday work and night work, contrary to the convictions of the men, as indicated by their enthusiasm at the public meeting in May, 1860."

It will probably gratify you to hear that steps are now taken by the Corporation to compel the ventilation and cleansing of every bakehouse in the city which requires it, to prevent rooms above them being used as sleeping places, and to allow no youth to be employed at night work.

As an example of the benefits of considering and agitating sanitary legal amendments in the Statistical Society, I may mention that it was mainly through the exertions of the members of that body that the *Bakehouses Regulation Act*, 1863, was extended to Ireland. This act seems to require some slight alteration. Thus, entry is only granted during the hours of baking (nine p.m. to five a.m.)—a period so inconvenient that inspection will never be constant or effective. Lime-washing once in six months is too seldom, as the plentiful evolution of carbonic acid rapidly destroys its efficacy, and rooms above the bakehouse without abundant ventilation should not be used as sleeping-places, as the heated noxious gases ascend. The act only concerns sleeping-rooms on the same level as the bakehouse. There are sixty-eight bakehouses in Dublin. Before the act was enforced nearly all the walls were dirty, whitened but once yearly, the ceilings were dusty, and they were ill

aired and dark. They have been much improved. No youths under eighteen were found employed. Inspection is quarterly. The description by Dr. Gordon, in his work on "Army Hygiene," of the Indian bakehouses, is not agreeable. The grinding room is usually thirty feet by twenty, and aired by four windows a foot square, but almost closed by bamboos. In this place some thirty women are seated, the mills for grinding the corn interlaced between their bare legs, and some ten more women are employed in the carrying the corn and sifting the flour. The Indian temperature adds to the insalubrity of such a place.

It has often been asserted that residence in or near stables was wholesome, a statement for which there is not the least justification; but, on the contrary, Dr. Hillier, of London, has shewn that in St. Pancras, a population of 200,000, 1600 lived in rooms above stables, and their mortality was one-fourth greater than that of the other inhabitants. The deaths from hooping-cough were three times, from nervous diseases of children, twice, and from pulmonary complaints nearly one-third greater.

Printers in some of the cheaper places in London are exposed to the most unhealthy conditions; for instance, the compositors on a Sunday newspaper were found to be kept continuously at work from Thursday morning to Saturday night, and at night, to prevent the blowing about of the gas, which is never protected by shades, the windows are often kept closed. The absorption of lead and antimony from the type by their moist hands often leads to slow poisoning by the metals, very slow pulse and palsy of the hands being occasionally seen; and among stereotype-founders the inhalation of vapours has also produced metallic poisoning. The excess of work for compositors during the session of Parliament tells visibly on the London printers.

The humbler rank of clerks who sit at desks often

contract the habit of leaning against it, and impeded breathing and its result, consumption, often follow. The addition of a back to the old-fashioned office-stool would be a remedy, as well as the encouragement of games of athletic skill, instead of indoor pleasures, for their unoccupied time. The never-ceasing use of the pen pretty often leads to a serious deformity of the hands, known as writer's cramp. The constrained and often crooked position they often assume has led to curvature of the spine—a disease frequently produced in girls by similar causes. Another trade in which the evil influence of a constrained position, added to the pressure of their last against the pit of the stomach is seen, is shoemaking, for very few follow this employment without becoming confirmed dyspeptics. The peculiar diseases produced by the introduction of lead, induced in painters and colour-grinders, are seen rather often in this city, where such simple preventives as absolute cleansing of the hands before eating, and the use of sulphuric acid, which in water makes an agreeable drink, are often neglected. In Edinburgh the disease is scarcely known, owing to attention to the above rules. Those who work with lead are said to be very subject to gout, which I suppose depends on the union of the oxide of that metal with uric acid, which is the essence of that disease. A similar example of neglect of easy and effectual remedies is afforded by the steel-grinder's disease. Magnetized wire gauze respirators entirely prevent the steel particles from entering the lungs, yet the Sheffield grinders are most unwilling to wear them; on the other hand, in some chemical works in this city so simple an expedient as keeping a piece of cotton cloth in the mouth has proved effectual against the inhalation of poisonous vapours. Particles of dust excite consumption most powerfully; for example, it was found that 91 per cent. of the deaths among the stone-cutters and masons of Cologne were from that malady. In Sheffield

the hours of work at the steel trades are often excessive under occasional pressure. Thus, the Employment Commission records that "a boy nine years old worked at crinoline steel-rolling three nights running, as well as three days, and this under his own father." Their ignorance was shown to be most lamentable.

Thackrah (1832) gives the following list of the workmen who were affected injuriously by the dust of their trades, and the same list will almost do for the present day: "Corn-millers, malsters, teamen, coffee-roasters, snuff-makers, paper-makers, flock-dressers, feather-dressers, shoddy-grinders, weavers of coverlets, weavers of harding, dressers of hair, hatters employed in the bowing department, dressers of coloured leather, workers in flax, dressers of hemp, some workers in wood, ware-grinders, masons, colliers, iron miners, lead miners, grinders of metals, file cutters, machine-makers, makers of firearms, button-makers."

I lately saw a consumptive patient who also owed his disease to an ill-regulated trade. He had been working for about twenty years in a flour-mill near this city, and partly from cupidity and partly from obedience to his employer, for refusal would lead to dismissal, he had often worked both day and night, two hours in the evening alone being given to sleep. He worked in this way for six days and nights on one late occasion, but being seized with spitting of blood, was admitted into hospital. Exhaustion from length of labour, and the entrance of flour particles into his lungs, for these places are often ill-ventilated, excited his disease, and there are very few of the men who work at the trade who do not suffer from difficulty of breathing from the latter cause. In steam-mills night work is not usually allowed, but in water-mills, as the power is so limited, day, night, and Sabbath are alike. Is not such a system to be deplored, and is not legislative interference called for?

There is, I believe, no regular match manufactory in this city, but a fearful disease attacks those who work at this employment in London and Edinburgh—namely, death of the jaw bone from the inhalation of phosphorus vapours, a severe surgical operation being necessary for its removal; but unfortunately, as in other instances I have mentioned, the workmen neglect precautions, however simple and effectual. In one factory twenty-four cases of this phosphorus disease had occurred, but not one since it was properly ventilated, and amorphous phosphorus substituted for the old kind. One fellow is believed to work at this trade in his room, but he always eluded the vigilance of the inspectors.

The evils from want of exercise and pure air which afflict young girls employed at millinery and dressmaking, especially during the fashionable season, come before every physician to an hospital or dispensary, they are consumption, dyspepsia, and menstrual irregularities, which are productive of the worst results, such as womb diseases, sterility, or inability to suckle children, if they marry and bear any. The female cloth-workers of Bradford are said to be very subject to epilepsy, the confinement and frequently dissolute habits being the exciting causes. Factories are now so thoroughly inspected that great improvements have taken place in the health of the operatives. The only disease which is said to be frequent among the linen-workers of the North of Ireland is a painful ulcer of the toe, which standing in wet with bare feet produces. The mortality by consumption in English manufacturing towns is, however, enormous; thus it is in Nottingham twice, and in Manchester nearly thrice as great as in the healthy agricultural districts, and this malady is certainly most preventible. Now, in France and other Continental countries there is much greater superintendence of occupations under legal authority; but in Britain that dislike to interference which is so general has prevented

many lives from being saved from the injurious effects of such causes. A prize has been founded in connection with the Paris Exhibition for factories, which shall exhibit greatest care for the social and sanitary state of their operatives, and exertions have been taken to have competitors from this country. In Paris, too, the Conservatoire des Arts et Metiers has long cultivated an interest in sanitary matters by exhibiting in motion all the apparatus used for the preservation of human comfort, health, and life. The chemical and microscopic matters in water are also constantly demonstrated. That the provision of such care should not be left to proprietors, is shown by the fact I before mentioned in regard to copper and lead mines, which are not ventilated, as no explosive gases endanger life and property as they do in coal mines, and in some of them in this country, the only means adopted are horizontal shafts of but four feet high, carried for a mile without any ventilating passage up to the atmosphere.

As cases of slow mercurial poisoning are due in a great measure to the neglect of precautions which should be made obligatory on manufacturers by the authorities to whom the care of the public health is entrusted, I will enter somewhat fully into the subject, and will first detail two cases which lately came under my notice.

The first man had worked for twenty years at the mirror silvering trade without intermission, except when disabled by the effects of the mercury. His habits had been temperate, porter being the only stimulant he took. He had been very neglectful of ablution before meals, and of ventilation in the room in which he worked. The first symptoms he suffered from were, coppery taste, salivation, diarrhœa, weakness, depression, and irritability of spirits; but for about four years he did not suffer from the tremor. He was very apt to sweat on making the least exertion, the perspiration having the peculiar mercurial fœtor. When admitted into hospital

he was wretchedly emaciated; his skin had a peculiar bluish paleness; every muscle trembled, and he stuttered constantly; he did not tremble during sleep, but was very uneasy, and apt to start up.

The peculiar kind of stammering from which this poor fellow suffered has been called "psellismus mercurialis." This symptom was retained for thirty years in the case of Dixon, the anatomy porter of the College of Surgeons, who at one time rubbed in immense quantities of mercury. Professor Macnamara tells me that his chief difficulty lay in the pronouncing of long words, such, for instance, as that gentleman's polysyllabic name.

The second man had been working at the silvering trade for sixteen years in this city and in Liverpool. The first thing he observed on beginning the trade was a nasty taste in the mouth, not the usual taste of mercury distributed through the system, for it began in three or four hours after the first exposure. Salivation followed, and was renewed whenever he went back to work after an interval. So extreme had been the action on the mouth that he had lost nearly all his teeth, and was as helpless as a child. He is now very bald, and this, with the characteristic paleness and wrinkled state of his face, gives him the appearance of a very old man. Loss of spirits, and disinclination for the least exertion or amusement, were also early symptoms, and he at last became as apathetic as a sailor with sea scurvy, and, by the way, from the same cause, want of red blood-cells. He lost appetite for food, but drank porter rather plentifully. Spirits he could not touch, as a very small quantity would intoxicate him in his weakly state. He always had more or less of the "trembles," and even now, after several months' abstinence from work, shakes a little, and as the muscles have no enduring power of contraction, he cannot stand steadily. I may mention that he never knew a fellow-workman escape the disease in Dublin, whereas in Liverpool a minority suffered.

You see, therefore, that the ill effects of this trade are very deplorable, and, if generally known, would cast an expression of sadness over many a face reflected in the mirrors, the making of which have caused the evils; but, happily, they are in a great measure preventible.

The nature of the disease is somewhat obscure, but must consist in one or more of the following conditions: the spoiling of the nervous tissue, of the muscular tissue, or of the blood, of which you know a pure and plentiful supply is wanted for active muscular movement. Into all of these components of our body albumen, and the substances allied to it enter most largely and it may be that the mercurial salt coagulates and spoils them in the body, as it would in the chemist's test tube. A grain of corrosive sublimate will coagulate some hundreds of grains of albumen before its effects are neutralised. So that when Baron Thènard had accidentally taken a little of that poison he had to swallow as an antidote about a dozen eggs. The blood cells are composed of an albuminoid, and when they have dis appeared by prolonged maceration in water, a drop of a solution of bichloride of mercury will coagulate this compound and make them re-appear.

1. That it is not on the nervous tissue the mercury inflicts the greatest injury I think appears from the facts that other functions—memory and sensation, for instance—are not impaired, and that in most cases cure follows avoidance of the poison and perhaps medical treatment in a few weeks. In two cases lately published in the "Bartholomew Hospital Reports," in which the poison was introduced by the vapours of mercuric methide, the symptoms, however produced, were those of acute mania. The brain is no doubt highly albuminous, but that substance is contained in the interior of the nerve tubes, and is insulated by a coating of fat. Its remarkably low diffusive powers also would tend to keep it within the tubes.

2. If an opportunity of examining the body of a silverer should arise, it will be possible to ascertain if the mercury has penetrated the sheaths of the ultimate muscular fibres and shrivelled the albuminoid within them, and that perhaps it still lurks there itself. I think, however, it is now generally believed that the excreting power of the body is capable of throwing out mineral poisons within a very few days, except perhaps from the lungs, liver, and kidneys, from which they may fail to get discharged. It is not recorded that in cases of mercurial poisoning the metal was found in the muscles.

There is one diseased condition of muscular fibre which we discusssed before—namely, fatty degeneration, in which the musculin is found to be replaced within the sheaths by that fat known as adipocire. This change is accomplished by the evolution of nitrogen, for as no pores can be discovered in the sheath, it is hard to conceive how the musculin could be conveyed out and the fat conveyed in. The fatty muscle has not, however, the irregular mode of contraction which appears in mercurial tremor, but has that sluggish action we see in the muscles of a diseased limb, or of an over fattened ox, or that proneness to stop altogether which we find in cases of death from fatty heart. However, it is probable that chemical degeneration of the muscle would lead to the trembling which follows mercurial poisoning, and that, whether the muscle be merely an instrument played on by the nerves or contracts by a force inherent in it, which question physiologists still dispute.

I am not aware if the intimate nature of the shaking palsy of old age has been demonstrated, but it is very similar to mercurial tremor, only differing in the fact that the muscles remain quiet if no effort be made to move them. It might be due to either of the foregoing conditions, or that now to be discussed.

3. From the time of Huxham, it is known that mercury spoils the red cells of the blood, and Dr. Farre

says, "A full plethoric woman of a purple red complexion consulted me for hæmorrhage from the stomach depending on engorgement without organic disease. I gave her mercury, and in six weeks blanched her as white as a lily." The red cells of the blood are by no means permanent, but, on the contrary, are constantly being destroyed by the liver and cast off in the bile, the stock being being renewed out of the white cells. This action of the liver is stimulated by mercury, and it is thus a course of that medicine pales the body, as that agent has spoiled many cells. Now, all the silverers I have met with have suffered, especially in the beginning while they had blood to lose, from bilious purging. It is this loss of red cells to even one-sixth of their amount, and necessarily higher proportions of white, which renders the blood of persons under mercury buff and cupped when drawn, and a peculiar fœtid matter similar to that which is thrown off in the saliva and evacuations is found in that fluid.

From the moderate and careful way the drug is now given, we never see mercurial erythism. Sir T. Moriarty, however, records that it was very common in Dublin in the beginning of this century. It consisted of sudden and sometimes fatal faintings, presumably due, as I suggested in my "Manual of Physiology" (2nd edition), to rapid destruction of the red cells and consequent failure of the heart's contraction. One of the most graphic accounts of the disease was related by Dr. Bateman, F.R.S., in the ninth vol. of the *Med. Chir. Trans.*, as occurring in his own person, and the prominent symptoms were weakness of the muscular tissue, including that around the intestines, which allowed the accumulation of gas to a most painful extent.

No tissue requires a more constant, abundant, and pure supply of blood than muscle when contracting; it is therefore easy to conceive that the stream spoiled by the mercury will lead to weak and irregular action. It

may be said that the brain would equally suffer, but Chossat's experiments on the starvation of animals proved that while muscles failed and wasted first from the deficient supply of blood so produced, the brain held out almost to the last. In cases of acute mercurial poisoning the tremor appears within two or three days, and there is scarcely time enough, or poison enough, to produce much effect on the brain or muscles, but the increased action of the liver would rapidly impoverish the blood. Mercury has been, moreover, found in the blood, but so intimately combined with albumen that destructive distillation was necessary to extract it, and a decomposed form of albumen was found also in the blood.

The process of silvering, as I saw it conducted, is to place a sheet of tin-foil on a large stone slab, and to pour over it mercury to about a quarter of an inch thick. The glass is then carefully slid over the surface of this amalgam, the oxide being removed to the sides of the stone or the grooves along them, and a lustrous surface being left next the glass. With small and inferior plates they sometimes place a sheet of paper between the mercury and the glass and then withdraw it. It is the oxide or dust, which being diffused in the air, or introduced from the clothes or skin of the workmen which paoduces the disease. On damp days, when mercury rapidly oxidizes, it is difficult to silver, and the men are induced to shut out the air, and to raise the temperature by large fires. By such means the danger is greatly increased, as the mercury is vaporized, breathing is quicker, and the perspiring surface catches the mercury.

If the mercury be impure or mixed with dust, or the slab dirty, it will "tail" on the stone, oxidize freely, and so do more harm.

Workmen are affected with the mercury with remarkably different degrees of severity, a fact which has a parallel in the giving of the drug as medicine, for two

grains of calomel prescribed as a purgative proved fatal by salivation and destruction of the jaw.

Any workmen showing susceptibility should be removed to some other branch of the business, or obliged to relinquish it altogether. That it is very hard to persuade them to such changes may be learned from a case related by Merat, in which both parents had been affected with trembles at his birth and until their death, yet he pursued the business in the most neglectful way.

A gentleman stated to me lately that he read in some magazine years ago that persons intended as miners in mercury mines were rendered insusceptible of the effects of the metal by taking for two or three months previously large doses of arsenic. I have been able to obtain no confirmation of the statement, nor can I understand it; but, if true, it would suggest that arsenic would also be a curative agent.

Prevention can be accomplished, to a very great degree, by the following means:—1. Free ventilation to be attained by height of premises, open windows, and louvred shafts at the summit of the rooms, or best of all, by a special fan and shaft; the mercurial particles will be in these ways carried off. 2. The wearing while at work only of some easily washed dress. 3. Abundant opportunities for ablution of the hands and mouth aftea leaving work, and always before meals, which should not be eaten in the work-rooms. Frequent baths are also most useful. 4. The wearing of a wire gauze covering over the mouth, nose and ears; a handkerchief is now occasionally used over the mouth, in the way which even Pliny described, but gives very slight protection. 5. Means of catching the dust, such as sheets of strong paper with holes in them placed in advance of the walls. The dust passes through the holes, and may be collected in troughs along the edge of the floor. Round the edge of the silvering stone there is a groove for collecting the dust, and it strikes me that

if glycerine or some other sticky matter were placed in it or at the edge of the stone, the dust could not rise. Water would not suit for this purpose, as the vapour from it would dull the silvered surface, but the dust might be perhaps swept frequently from the groove into a vessel of water on the floor. The dust is preserved for the purpose of being distilled, and at all times should be kept in air-tight vessels, for mercury volatilises even at ordinary temperatures. 6. Working only at intervals, such as every second day, with an occasional month's respite altogether; this is the habit in England, but no intermission is usual in Dublin. From such neglect it follows that no one going to the business in this city ever escapes the disease, whereas Dr. Whitley, who reported on the subject for the Privy Council, in describing a London establishment says:—"No well-marked case had occurred for many years among men who had worked there only, and he believed that in well-arranged work-shops, with cleanliness and temperance, the danger, except to those peculiarly sensitive, is not great. All that I observed in most of the other places I visited served to confirm the above."

Up to the present the Legislature did not empower any one to interfere with this and many other injurious employments in this country, but the Public Health Act provides to some degree for their regulation; and an extention of the Factory Acts might arrange the due number of hours of work. At present not more than eight or nine persons are engaged at silvering in Dublin, but the business is increasing. For the entire prevention of the ill effects of mercurial trades, we must appeal to the noble science of chemistry, of all branches of knowledge the most useful to man, and it may be possible by some such method as precipitating the mercury to avoid the danger altogether. This mirror I show you is made by throwing down silver from the nitrate according to Petit-Jean's process. It is more

brilliant, as lasting, and cheaper than mercurial plate, and quite harmless in the making. I trust the process will be generally adopted, It is described as follows by my learned friend, Dr. MacCormac:

"Petitjean's procedure for silvering glass:—1540 grains of the nitrate of silver are treated with 925 grains of the strong solution of *ammonia*, then 7700 grains of distilled water. To this solution, when clear, add 170 grains of the tartrate of antimony dissolved in 683 grains of water, then 152 cubic inches of distilled water are to be added with agitation. When settled, the clear liquor is to be poured off. Then, to the solid residuum add other 152 cubic inches of distilled water. The clear liquors are now to be put together, and add 61 cubic inches of distilled water. This is silvering solution No. I. Silvering solution No. II. is to be prepared as before, only with twice the amount of tartaric acid. A planed cast iron table, levelled with a level, and containing water at a temperature of 140 degrees F. gas heated, is the apparatus. The glass to be silvered is well cleaned with a soft cloth, then with a plug of cotton dipped in the silvering fluid, to which a little polishing powder is added; lastly, with a second plug of dry cotton. The glass, laid flat on the table, is carefully covered with silver solution No. I. spread with a cylinder of india-rubber stretched on wood and cleaned with the solution. In from ten to twenty minutes the silver begins to be deposited. After a certain time, push the glass to the table edge, tilt so as to let the fluid run off, wash and examine. The next thing to do is to pour on silver solution No. II., after which wait, tilt, wash, and dry. Finally, cover the work with red or black varnish."

These mirrors cost but 1s. 8d. per square yard for silvering. Gilding with an amalgam of mercury and gold was most noxious, but has now been superseded by electro-plating. Some other trades which use mercury, as barometer makers and furriers, also suffer from its effects, as do likewise to a fearful degree the miners who work at Almaden and Idria, near Trieste, where the metal is obtained. In 1803 a fire broke out in the latter mine, and over 905 persons in the neighbourhood were attacked with the trembles. At these mines even at present the mode of extraction is so rude that the miners suffer from the fumes most lamentably. Mercury being volatile, it may occasion disease if it be not

carefully stored. Thus in 1810, the *Triumph*, man-of-war, having taken a large quantity of the metal from a wreck, the bags burst, and 200 of the men were salivated, and every animal, including birds, mice, and even cockroaches, were destroyed. It was at one time asserted that the corrosive sublimate in the timber, preserved by Kyan's process, was injurious to sailors, but a commission of the French Academy in 1836 disproved the statement.

Shopkeepers in small towns wholly ignorant of the nature of drugs frequently retail laudanum, tinctures of rhubarb, or senna, or black draughts, and their assistants, who most frequently cannot read, may just as readily supply you with any one as the others. Many sad instances of this are related by Professor A. S. Taylor in his famous "Medical Jurisprudence," and in his Report to the Privy Council in 1863. He quotes one case which many of you recollect, namely, that of the Rev. Dr. Alexander, who died by arsenic which was supplied by a shopkeeper in Ferbane instead of arrow-root. In another of this man's drawers were found, loosely papered, rice, corrosive sublimate, jalap, and oxalic acid, and all were under the care of an ignorant boy. In another instance, 12 pounds of arsenic was sold by a druggist in mistake for plaster of Paris to a cheap confectioner, who having next day retailed it in the form of lozenges, poisoned about 200 persons in the town of Bradford; and in Stourbridge 500 persons were attacked with lead poisoning, owing to the accidental mixing of 30 pounds of sugar of lead with 80 sacks of flour.

For criminal purposes, also, strychnia and other fearful poisons can, owing to a want of legal restrictions, be obtained by any person who alleges the destruction of vermin as their object.

The remedial measures which Dr. Taylor proposes are mainly that none but skilled persons shall retail those dangerous agents, and then only to known persons,

and for purposes ascertained. All poisonous drugs should be kept apart, distinctly labelled, in bottles of a peculiar shape, or with a label edged with sand paper, so that they might be distinguished even in the dark.

An average of 550 deaths by poison annually occurs in England, and three-fourths of these are by arsenic and opium, the vulgar having happily no knowledge of less easily detected agents.

Some simple information with regard to the best thing to do for persons who have taken the more usual poisons may be appended to this lecture, such as the following:

Acids—such as oil of vitriol (sulphuric), aquafortis (nitric), spirits of salts (muriatic), oxalic—magnesia, chalk, whiting, or if nothing else be available the plaster of a room, powdered and mixed with water, should be freely given. Soap-suds and oil are also useful.

Alkalies—such as potash, soda, hartshorn (ammonia), lime—vinegar and water and oil are antidotes easily had.

Arsenic is a poison to which there is no antidote, but magnesia and powdered charcoal are useful, and hydrated oxide of iron is better if it can be had.

Caustic (nitrate of silver) is at once rendered inert by common salt.

Corrosive sublimate (chloride of mercury)—eggs beaten up, or flour and water.

Lead Salts—Epsom salts, mixed with vinegar and water.

Opium—A tablespoonful of mustard every fifteen minutes till vomiting occurs; forced exercise, and plenty of strong coffee; dashing with cold water, and artificial breathing.

Prussic Acid—Dashing with cold water and artificial breathing in the open air, as advised for drowning. In cases of suffocation by gases from sewers, wells, or brewer's vats, the same steps are advisable.

STRYCHNIA—A mustard emetic, and then five grains of tobacco, infused in half a pint of water, are the best treatment before the arrival of the physician.

TARTAR EMETIC is best neutralized by strong tea or a decoction of bark or of oak bark.

As public attention has often been called to the want, in this city, of appliances for the recovery of drowned persons, it may not be out of place to quote the following memoranda on recovery from drowning, which I made by direction of the Municipal Council in April:

"I have recently visited several Stations of the Royal Humane Society, including the chief Station on the Serpentine, and have communicated with the Secretary and Surgeons, and I submit a copy of their Annual Report, and copies of their Notices. It is of the utmost importance to instruct the public on the best means of reviving the person immediately on being rescued from the water, and while being carried to the nearest hospital or recovery-house, upon any car, cab, cart, door or stretcher, which may be first procured. For this purpose I would suggest that notices, such as the enclosed (which are slightly altered from those of the Humane Society), should be posted in conspicuous places, especially in the vicinity of waters.

"The plan pursued by the Royal Humane Society in London would be the most suitable for Dublin, and the most economical. It is, that a tavern at about every quarter of a mile along the river, or as near as possible to other waters, should be a station, where a drag, pole, and ropes should be kept in readiness for use by the porter of the establishment and the police. The porter and the assistants of the establishment should be fully instructed in the method of reviving the drowned, which I have described, and a warm bed and other appliances for restoring warmth should be always available. The proprietor should be paid £1 for every drowning case treated in his house.

"A general medical practitioner should be chosen as medical officer, for a limited district, and his services, or those of his assistants, would be always available. In London they act gratuitously, and are selected solely on the grounds of proximity to the water. I would willingly give my aid in the after treatment of every case.

"Such of the hospitals as are near to waters might in certain cases be still resorted to; but the drowning case on Monday last proved how dangerous it is to convey patients to them from long distances. The unfortunate woman shewed signs of returning life while being carried, but was beyond hope when the hospital was

reached. After the drags were purchased, the only annual expense would be the reward of £1 in each case, the total number of which is about 40 in the year.

"The notices containing the instructions for recovery might also give the address of the Stations and of the Medical Officers, and they should be posted extensively.

"Medals and Certificates would be awarded by the Royal Humane Society, as is stated in the Secretary's letter.

"The following might be adopted as a form of Public Notice :—

MAP OF DUBLIN,

Shewing the Recovery Stations.

TREATMENT OF DROWNING.

"1. Convey the patient, *at once*, on any available vehicle to the *nearest* hospital or recovery-house, after having turned the body for a minute on the face, to allow water to escape. Notice should be sent immediately to the nearest hospital or recovery-house.

"2. Place the body on the back, with the head and shoulders slightly raised; free the mouth and nostrils, and draw forward the tongue, and keep it so, if necessary, by a band round the jaw.

"3. While the patient is being carried draw in air, by pulling the arms quietly and steadily above the head, and after keeping them so for two seconds force out air, by folding them down, and pressing them against the sides for two seconds, according to Dr. Silvester's method, approved of by the Royal Humane Society, &c. These movements are to be repeated regularly fifteen times a minute, until spontaneous breathing occurs, when circulation and warmth may be promoted by means hereafter mentioned.

"4. While the above means are being used, apply snuff or smelling-salts to the nose, or tickle the throat with a feather, and rub the limbs and face briskly in the direction of the heart.

TREATMENT AFTER BREATHING IS RESTORED, IF MEDICAL AID BE UNATTAINABLE.

"1. Promote warmth and circulation by (1) a warm bath for five minutes; (2) by rubbing the surface briskly towards the heart; (3) by warm blankets or flannels, and bottles of hot water, or heated bricks to the pit of stomach, armpits, thighs, calves, or soles of feet.

"2. When the patient can swallow, small quantities of wine or spirits, with warm water or coffee, may be given, and if difficulty of breathing is complained of, mustard poultices will give relief."

A Mortuary House, to which bodies of the drowned persons, and others accidentally killed, may be conveyed for identification and subsequent inquest was erected in Fishamble street through the exertions of the Health Committee, but the influence of those living near it caused its abandonment, and the attempt to use the building as a hot-air chamber failed from the same reason.

If time did not press, I might try to interest you with the physiology of want of breath, the condition to which the hard but not half so accurate term *asphyxia* is generally applied. It is the mode of death in cases of suffocation, smothering, overlying, and many poisonous gases, as well as drowning.

LECTURE XVII.

THE PREVENTION OF ZYMOTIC AND CONSTITUTIONAL DISEASES, FEVERS, ERUPTIVE DISEASES, DIARRHŒA, CONSUMPTION, ETC.

HAVING now discussed the principal physical agents which influence the health of communities, in doing which I had occasion incidentally to mention some measures which have been found effectual in lessening the ravages of many diseases, I have thought it well to offer you a few observations upon the nature and prevention of those over which we have most control. As my object is to spread such information amongst the general public as may be practically useful, I shall at once tell those professional students who are among my hearers, that I shall not attempt to lecture them on the diagnosis and treatment of disease, for which they may entirely depend upon my own venerated former teachers, the Professors of Medicine and Surgery in this College.

The diseases which are most clearly preventible are those which are usually grouped under the title of "Zymotic"—a term which I shall endeavour to explain to you, for no more popular word conveys the same meaning, and I hope you will allow that throughout these lectures I have eschewed technical expressions, except when there was no more intelligible word, and when their meaning was explained by the context. It was Liebig who first expounded the resemblance of contagious diseases to the process of fermentation, and Farr, who applied the apt term "zymotic." In both, an infinitely small germ, gives rise to successive changes which propagate surprisingly the materal introduced—a circumstance which makes their virulence greater than that of mineral poisons. Thus, different from poisons of the

extraneous kind, the dose seems almost immaterial, but the zymotic agents agree with them in selecting some special organ on which their effects are produced; thus, as opium, arsenic and foxglove, no matter by what channel introduced, act respectively on the brain, stomach, and heart, small-pox acts on the skin, typhoid on the intestinal glands, and whooping-cough on the lungs. It is worthy of note that the fulness of the veins has a most remarkable effect on the taking up of the ordinary poisons; thus, a dose which will kill a dog in two minutes, will be fatal in one-fourth the time if the animal be bled just previously, and the full state of the vessels after food is the best armour against the introduction of contagious poisons; for such reasons I have constantly warned our students that breakfast should be always partaken of before the hospital visit. The *torula* or yeast germ can be removed from air by filtration, and such air is then incapable of promoting fermentation—a fact which suggests that air can be filtered of, or purified from, the seeds of contagion. The idea that for fermentation and putrefaction the presence in the air of organized forms is necessary, is first to be found in the writings of Bishop Berkely (who, it will be remembered, advised tar as a disinfectant), but that such is the case has been demonstrated by Pasteur and a commission of the French Academy, who quite confirmed his results. Filtered air was quite incapable of promoting either the one process or the other, and there is every reason to believe that the same may be said of zymotic diseases. The germs found were much more numerous near the surface of the ground. On the other hand. Liebig and other leading chemists regard as the ferment organic matter in a changing state which sets up similar changes in fermentible or putrescible masses. When cells of the yeast plant are introduced into the solution of sugar, they are multiplied by feeding on it, and alcohol and carbonic acid are evolved. It may be that the

poison-cell of specific diseases increases at the expense of the fibrin of the blood, and evolve some noxious matter which produces the phenomena of the disease. The liability of those in fever, and other zymotics, to be preyed upon by vermin which infest the skin, is a noteworthy fact. While, however, we exert ourselves to free the air from the contagious emanations of a patient, we should remember that the causes which originally acted is more potent; for instance, there is more danger of typhoid from residence near a neglected sewer than even a prolonged sojourn in the sick chamber. My friend, Dr. Leared, has ingeniously proposed to distinguish the emanations in the air around various infectious cases, by Professor Tyndall's instrument, which is able to test various gases and odors by the degrees with which they obstruct waves of heat.

"Little is known," says the Registrar-General, "of the immediate chemical or vital causes of epidemics; but in given circumstances, where many are immersed in an atmosphere of decaying organic matter, some zymotic disease is invariably produced. Where there is starvation it is most frequently typhus; cold, influenza; heat, cholera, yellow fever, plague." "Typhus," Professor Christison says, "puts on the epidemic shape only at periods of want among the labouring classes."

Perhaps the most remarkable feature about these contagious diseases is that they attack us but once, and the circumstance is unexplained, unless it is that each zymotic exhausts the peculiar pabulum in the blood on on which it feeds, and which is probably fibrin. Those of human origin, and which are communicable, attack the negro race with peculiar virulence, whereas that race is almost free from the malarious type. Thus, while the white American troops were attacked with ague to the rate of 10·80 per cent., the negro soldiery were attacked in the proportion 0·80 only. This I would attribute to habituation to the poison, and the influence of

habit, which is so positive in regard to chemical poisons, may be true of all the zymotic poisons which attack man. Neither can we explain their occasional epidemic progress or increased virulence under various meteorological conditions, although similar influences affect the diseases of the lower animals concurrently, or a short time previsusly, as has been shown by Sir William Wilde in his histories of the Irish epidemics, which I will allude to in talking of that interesting disease, the cattle plague. One more fact to convince you of the importance of the topic. One-fourth of all the deaths which occur in these kingdoms are due to zymotic diseases, which, moreover, tell chiefly upon the youth and flower of the population.

While preventive measures are undoubtedly efficacious against zymotics as regards treatment, in no class of diseases must the physician depend more entirely on the "vis physiologica vel medicatrix naturæ;" that is, he should rely a free supply of air, and other attentions to the normal functions such as are generally grouped under the term "hygienic treatment," endeavouring, meanwhile, by nutriment to sustain life till the poison has been eliminated. Dr. Richardson of London has shown that in some of these diseased conditions, the breathing being normal, the patient sinks for the sole and simple reason that the blood will not take in the oxygen that is brought to it. In such cases the blood is charged with compounds which by their presence prevent oxygenation—precisely as antiseptics prevent that process out of the body. In typhus this is the common mode of death, and he terms it asphyxia commencing in the blood.

The author of that most interesting work, "Rab and his Friends," forcibly advises the poor of their duty respecting infectious diseases, "Keep out of their way; kill them by fresh air and cleanliness; defy them by cheerfulness, good food (*better* food than usual

in such epidemics as cholera), good sleep, and a good conscience."

The fluctuation of epidemic diseases which are as yet obscure, are indicated in the following table of deaths in England, prepared by the Privy Council Medical Officer:

Years.	Scarlatina.	Diptheria.	Measles.	Hooping Cough.	Smallpox.	Fever.	Diarrhœa, Dysentery, and Cholera.
1838	5,802	—	6,514	9,107	16,268	18,775	3,440
1839	10,325	—	10,937	8,165	9,131	15,666	3,493
1840	19,816	—	9,326	6,132	10,434	17,177	4,799
1841	14,161	—	6,894	8,099	6,368	14,846	4,198
1842	12,807	—	8,742	8,091	2,715	16,201	7,622
1847	14,697	—	8,690	9,260	4,227	30,994	15,630
1848	20,502	—	6,867	6,862	6,903	22,037	15,604
1849	13,111	—	5,464	9,615	4,645	18,347	74,155
1850	13,370	—	7,080	7,770	4,666	15,375	14,400
1851	13,594	40	9,370	7,905	6,997	17,930	18,945
1852	18,813	74	5,846	8,022	7,320	18,641	21,754
1853	15,653	46	4,895	11,200	3,151	18,554	20,502
1854	18,325	203	9,277	9,770	2,808	18,893	42,092
1855	17,128	186	7,354	10,185	2,525	16,470	15,044
1856	13,931	229	7,124	9,225	2,277	16,182	15,912
1857	13,919	310	5,969	10,138	3,936	19,016	24,037
1858	26,481	4,836	9,271	11,648	6,460	17,883	16,004
1859	19,907	9,587	9,548	8,976	3,848	15,877	20,597
1860	9,681	5,212	9,557	8,555	2,749	13,012	11,185
1861	9,077	4,517	9,055	12,309	1,320	15,440	20,999
1862	14,834	4,903	9,800	12,272	1,628	18,721	12,667
1863	30,475	6,507	11,349	11,275	5,964	18,017	16,801
1864	29,700	5,464	8,323	8,570	7,684	20,106	18,366

Small-pox is the typical zymotic disease, and the circumstances which increase liability to its contagion are—1. Early age, as it has not been endured before. 2. Want of the protective measures to which I will just now refer. 3. Peculiarity of race—thus, the negro and other

dark races are most susceptible of the poison in its worst form; many millions of North American Indians perished when the contagion was introduced. 4. Health depressing causes, and perhaps fear is among them. And 5. Epidemic influence. This disease was lately three times as frequent in Ireland as in England, and twenty times as in Continental countries were vaccination has been for years compulsory. In 1863, the dispensary medical officers in Ireland attended 1486 cases of small-pox, yet out of the 128,850 children who were born, but 106,510 were vaccinated; but on the first day of the year 1864 there came into force the Act which obliges every child to be protected under penalty. In England, some years ago, Mr. Simon, at the head of this department, said, "Millions of vaccinations have been performed with lymph not fully possessing its original endowments." And as it was also found that the Vaccination Acts, although compulsory, were not effectual in checking small-pox, the Privy Council ordered systematic inspection of 1143 districts in England to be made during 1864. To show that exertions to eradicate this fearful disease were more urgently required in this country, I shall borrow the statistics collected by the Epidemiological Society. The proportion of deaths by small-pox to 1000 deaths from all causes is as follows:—

All England	...	...	...	21
London	...	...	...	16
Edinburgh	...	...	...	19
Dublin	...	...	...	25
Connaught	...	...	...	60
All Ireland	...	...	...	49

In this country, moreover, nearly all the deaths occurred in persons unvaccinated. For 13 years in Copenhagen, and eight in the Duchy of Baden, not one death by small-pox occurred. For many years before, vaccination had been compulsory.

The £5 penalty for practising inoculation by small-pox matter does not seem to be a punishment severe enough, for at the Summer Assizes, 1864, there were in one county alone (Donegal) four cases of homicide from this fatal practice. The best instance of the efficacy of the other protective measure I can give you is the fact that for twenty-eight years in the London Small-pox Hospital not a nurse or servant has caught the disease, for every one of them has been vaccinated or re-vaccinated on their appointment.

You are, perhaps, aware that the small-pox poison is transmissible to lower animals; for example, the well-known case where a cow took the vaccine disease from having lain upon some flock from the bed of a small-pox patient. Ovination, a similar operation to vaccination, was practised extensively in England in 1863 by the veterinary surgeons as a preventive to small-pox in sheep, and for the same purpose vaccination was performed in thousands of cases to prevent the cattle plague. Some indirect benefits are likely to accrue from vaccination, for it has been shown in Sweden that scrofulous complaints are much less frequent since the protection has been made compulsory. In this and other practical benefits the truth of the immortal Jenner's prophesy is been realized: "the best and keenest of all arguments for vaccination will be those that are engraven with the point of the lancet." I do not think it has been fully determined whether or not the offspring of those who have had small-pox or been vaccinated are in any way protected. The poison of scarlatina seems the most contagious of all its class, having the greatest infecting distance, and fixing with the greatest tenacity in dwellings, furniture, or clothes—fomites they are technically called. For this reason when the disease breaks out in schools, it is generally politic to close them up entirely for some time. The heat of boiling water, which may be applied by means of heated air, destroys the poison,

but if a hot air chamber be not procurable, rooms or clothes in which the poison may be lurking, should be thoroughly fumigated with sulphurous acid emitted from burning sulphur. Dr. B. W. Richardson relates an instance in which, during four months, every effort short of removing the straw roof of a cottage, failed to remove the contagion. The disease is inoculable, but the malady so produced being as severe as the ordinary kind, such an operation is not advisable. The most malignant epidemics of this disease from which Ireland has suffered were in 1801–2–3, and 1834. It was extremely prevalent in Kingstown during 1865. I have long thought that the addition of separate wards in hospitals for the treatment of the eruptive fevers of children would tend in a great degree to check their prevalence.

Measles poison would seem to be nearly as contagious, for instances have occurred of the disease been carried by children's clothes packed in a box and sent from schools where the epidemic had broken out. In the late American war, this disease assumed a serious aspect, for 22,000 soldiers were prostrated by it during the first year's campaign. I may mention that Dr. Salisbury of Ohio has endeavoured to prove that the measles poison owes its origin to a fungus which grows upon rotten straw. He inoculated himself, his wife, and twenty-seven other persons with this fungus, and in all an eruption similar to measles followed, and none of these individuals so protected caught the natural measles, which just at the time was strongly epidemic. This gives us, *if the facts be positive*, a means of preventing measles analogous to vaccination, and it may be as safely practised as the induced disease does not appear to be communicable.

In connexion with this subject, I may remark that Dr. H. Kennedy has published an interesting case where a measles-like eruption followed the application to the

face of some mouldy flaxseed meal. In France lately it is recorded that wounds made with an instrument which had pruned diseased vines had produced severe illness and even death, it was supposed from the entrance of the parasitic plant oidium. Several hundred children in France are said to have been inoculated with measles by inserting a tear from a patient into a puncture.

The foregoing diseases are so usually contracted by children that we have begun to look on them as unavoidable. But my friend Dr. Druitt, the President of the Association of Health officers, has given good reasons for believing that the eradication of these domestic pestilences is possible. These poisons may lurk in the skin which may be unwashed for years after an attack of contagious disease, in the old clothes which pass during a series of years from one wearer to another, or in the carpet, curtains, or bedding, and hot air disinfection is the only available remedy. The paper of rooms, the sewers or ashpits, or even the earth of the foundation, may likewise harbour the germs of these diseases. Increased cleanliness has banished that loathsome disease, the *morbus pedicularis*, which a hundred years ago was common in hospitals, and a general inculcation and rigid enforcement of the same purifying means may cause the eruptive fevers to become unknown. Puerperal fever is a zymotic of great virulence, but happily very rare. It has occasionally burst out in this city, and the practitioners who met it here at once, in the most conscientious way, resigned practice, for a few days, as they believed the disease to be easily communicable.

In my Introductory Lecture, I endeavoured to impress on you that typhoid fever was about the mostpreventible of diseases, yet 140,000 cases occur, and 20,000 at least die of it every year in England, and as the average age of its victims is 21, and all ranks are obnoxious to it, the very flower of the people is included. I will not dwell on the subject further here, save to remark, that

in having pustules on the intestinal mucous surface, it resembles the diseases—small-pox, for example—which are characterized by peculiar eruptions on the skin. It is supposed that the seeds of this disease may dry up, and yet, like those of many plants, may germinate when submitted to favourable conditions. There is much greater risk of contagion from the decomposition of the poison in faulty sewers than from the atmosphere about the patients, and its progress is much more virulent when introduced by water drank than by air inspired, because of the greater concentration of the poison. The great rule of prevention is to destroy the discharges from the bowels by chemicals, and then bury them deep in the earth far away from any water source.

I will in another lecture enumerate many chemical destroyers or disinfectants of acknowledged efficacy, but I wish now to tell you that McDougal's fluid (crude carbolic acid), and McDougal's powder (carbolate and sulphite of lime), and green vitriol or copperas, are cheap, convenient, and thoroughly reliable in eradicating this pest "born of putrescence."

Typhus has always been Ireland's epidemic enemy, and is still five times as frequent in Dublin as London in proportion to the population. Epidemic in other countries, it is endemic with us; and, when I exhibited its prevalence in various towns last year, I was not recording an evil the dangers of which have passed, for, after having been nearly twice as frequent throughout Ireland in the last quarter of 1864 as in that of 1863, the Poor-law Commissioners report that "for the first five or six weeks of the present year (1865) the number of cases of fever continued steadily to increase, and the disease became in a few localities alarmingly prevalent." In Feb., 1865, the Poor-law Inspectors reported as follows:—Mr. Hamilton, North-western district, "There has been epidemic disease in some few parts of my district, but I attribute it more to defective sanitary arrange-

ments in a few towns and villages than to any want of proper food." Dr. Brodie, Western district: "The fever has been generally confined to towns, and from the class of persons attacked it is evident that it is not attendant upon destitution." Dr. King, in the same district, corroborates the latter statement, adding that fever prevails most intensely in towns through which rivers flow; for example, Limerick, Ennis, Boyle, Sligo, &c. Mr. Bourke for the Midland counties, Mr. Horsley for the South-western district, and other inspectors, repeat the same statements, that the fever was not due to destitution, that it prevailed in towns, and spread to the middle and upper classes, among whom it was proportionally more fatal. But in 1866 the evil was exchanged for cholera.

Even in Glasgow, a city noted for unhealthiness, to which I am afraid the presence of many of our poorer countrymen very much contributes, the annual fever-rate is but 1 in 200, and that of its very worse slum, 1 in 31. Dr. Lyons, in his Treatise on Fever, says that 222,029 perished by typhus between 1841–51 in Ireland.

In the epidemic of 1818 1½ million of cases occurred, and the fever hospitals of Dublin, Cork, Limerick, Waterford, and Kilkenny alone received 45,000 patients. Extreme droughts, which dried up the uncertain supply of water from wells, and putrefied the stagnant sewage, had much to do with the spread of this pestilence. The government organized a good system of inspection, which was discontinued when the epidemic subsided. Now it appears to me that it is in times of freedom from pestilence that inspection is most valuable, as then precautions are apt to be neglected, and, when epidemics are developed in a town, preventive action is nearly useless. Dr. (now Sir D.) Corrigan most truthfully remarks:

"The knowledge of the above facts will, I trust, induce those who are placed in power, and who possess wealth, to obviate such dangers, and to meet them in time, should they again invade us. Should there, however, be any who may require to be further urged, it is well they should learn that their own self-preservation is intimately concerned in the consideration. It is a curious circumstance in the history of the Epidemic Fevers of Ireland, that while the poor are attacked in greater numbers, the rich suffer more in mortality. The mortality among the poor is only about one in thirty, but the mortality among the rich is estimated at the lowest at one in three. It seems, therefore, that while the rich possess constitution and means, which enable them to resist the ordinary contageon of fever, the seizure, when it does come, is in itself demonstrative of a greater amount of virulence."

You all must have read of the lamentable way in which this fever decimated the army in past centuries, and the contagion was usually introduced in the following way: Commissions were given to those who collected a certain number of recruits, and a promiscuous rabble reeking with the seeds of typhus, was often obtained by ransacking the lowest haunts, and even the jails. In these latter places so virulent was the poison, that the judges, witnesses, and others, who were engaged in court rarely escaped, as I could relate to you if time permitted, from the writings of Lord Bacon. The assizes in 1577, at Oxford, were long remembered as the Black Assize, from the horrible catastrophe from the gaol fever. Baker, in his Chronicle, tells us that *all* who were present in the court died in 48 hours—the Judge, the Sheriff, and 300 persons. Terrible was the retribution suffered for the hardness of heart in denying even to criminals means of avoiding disease and preserving life. The intensity of the disease would seem now to be much less, for persons in the house with a typhus patient suffer little risk, and those in neighbouring houses none. I have investigated some cases in which the inhabitants of a house were reputed to have caught typhus from patients in a neighbouring one; but I have always found that the attack was due to an original focus usually

promoted by similar unsanitary conditions. If there be suitable arrangements for the exit of the infected air and the entrance of the fresh, I have never thought it necessary to banish relatives from the patient's house, for their affectionate solicitude is often more valuable than any hired services. The causation and intimate nature of fever is most admirably reasoned out in Dr. Hudson's Lectures just published. The man who is depressed by the want of fresh air is more liable to catch contagious disease; and in an overcrowded, ill-aired room it must spread to others when one is stricken down. During the fever epidemic of the first quarter of this century, the practice when a cottager was seized was to build off the part of the room in which he lay, and to introduce through the window any food or medicine he required. A more disastrous consequence of the ignorance among the people of the laws of health perhaps never occurred. One and a half million of cases was reported in the epidemic of 1818. The fever rate of Irish towns is constantly and fearfully higher than that of English towns, owing to defective house accommodation and the reception of vagrants, who spread the contagion. Irish-peopled English towns suffer much from fever; for instance, Liverpool, where 19-20ths of those attacked are of the labouring class, and the remainder those who come within the range of infection from them in discharge of their business or professional duties. The adult bread-earning male is the victim most prone to typhus: hence its pauperizing effects.

At Festiniog, a Welsh village favourably situated on the side of the adjacent mountain range, where the air is pure, the rainfall easily carried off, and the inhabitants usually healthy, fever broke out, and prevailed to such an extent as to demand inquiry by the Government. It was found that the great demand for labour at the slate-quarries had brought a population to the

place far above the accommodation available in the way of lodgings; and overcrowding in the cottages prevailed to a most pernicious extent. In cottages containing two low rooms, 8 feet by 6 and 12 feet by 6 respectively, 10, and even 12, people were found to be lodged. The work in the quarries was continued day and night, by relays of laborers, and in the same way the lodgings were occupied; the bed which one left to go to his labor being immediately used by another whose labor was done. The origin or cause of the fever was simple overcrowding, aided perhaps by excessive labor; if Festiniog had been inhabited by none but its original population, no epidemic would have arisen.

I will now recapitulate the circumstances which recent pathological enquiries have proven to be promotive, if not productive, of typhus, and you will acknowledge they are all preventible. 1, over-crowding and defective ventilation, which it has been plausibly stated will originate the disease; if putrescent animal matter be necessary for the development of fever, it is freely afforded by the collection of the animal matter which which is exhaled by the skin and lungs of inmates in an ill-aired room. I have calculated that a family of 5 persons living 12 hours daily in such a room would throw off 38lbs. of this animal matter in a year. 2, personal squalor, especially the wearing of clothes soaked in cutaneous exhalations, and dark-coloured woollen stuffs, have by far the greatest power of absorbing the poison; the means for aerial disinfection have been before described, but 5,000 cubic feet per head per hour is the readiest and best. Isolation, as by removal to hospital, is most desirable. Disinfection by heat is essential. 3, a low state of the system due to scanty or bad food; 4, a medium temperature.

Yellow fever is pretty often heard of amongst crews at Swansea (where in September, 1865, it attacked 20 townspeople), Southampton, and other ports, but the

cold of our climate frees us from chance of its locating permanently. Quarantine is always established by direction of the medical officer of the Privy Council. It is believed to be communicable by clothes, and one miscreant, during the American war, tried to spread it in this way.

As regards the most plainly malarious of diseases—ague—it used to prevail in Dublin and its vicinity; but owing to improved surface-drainage it has almost wholly disappeared. Dr. Flint, a great American physiologist, has almost fully demonstrated that the spores of palmellæ cause this zymotic. In my third lecture I said a good deal about malaria. The neighbourhood of Lazer Hill, now Townsend Street, used to be famous for cases of goitre dependant on the hardness of the water which soaks through the limestone gravel of its soil. In my Introductory Lecture I mentioned many pestilences now forgotten, but the miliary sweat, which has been known in France to follow the same haunts as cholera, is sufficiently severe to remind us of the sweating sickness, of which Armstrong, *our* poet, says:

> "Infectious horror ran from face to face,
> And pale despair—'Twas all the business then
> To tend the sick and in their turns to die;
> In heaps they fell, and oft one bed, they say,
> The sick'ning, dying, and the dead contained."

The next group of the zymotic diseases is that of which the breathing organs are the seats, and among them influenza is the most clearly epidemic, the most rapidly diffusible, and most largely fatal, at least 4000 persons in Dublin having succumbed to it in four months of the year 1837. Few old people escape if they are attacked; but Dr. Graves mentions a notable exception. He attended Judge Day, the contemporary of Goldsmith, at the age of 93, and he recovered perfectly. There are reasons for supposing that influenza is due to some specific poison floating in the air, and acting like the

emanations from the sweet-smelling vernal grass which gives rise to that remarkable disease, "hay fever." Others have surmised that the cause is a superabundance of ozone, and air highly charged with that subject will produce the symptoms of a cold, if breathed for a short time. Of prevention I have nothing special to say.

Whooping-cough, another zymotic, seems to be excited by some poison which acts exclusively on the branches of that widely distributed nerve, the pneumogastric. That the poison is not solely aerial would appear from a child just born having had the disease, which must have been carried to it in the mother's womb. Quinsy, croup, and diphtheria are other examples of this group of diseases, and in the prevention of all of them destruction of the throat discharges, ventilation, drainage of excreta, and removal of dampness, are hygienic measures of tried and positive efficacy.

Convulsions carry off so many infants in Irish towns as to greatly raise their mortality; and this disease is the effect of impure air acting on the susceptible nervous system of infancy.

The form of cholera, or rather severe intestinal disturbance, which is endemic in these countries, prevails, for reasons I explained before, during hot dry weather, and is in London contemporaneous with the putrefaction and stench of the contents of the Thames, and deaths in this city from the same disease have been registered by our dispensary medical officers every summer and autumn. About September many fresh-water plants die, and the decaying organic matter is often very hurtful to those who drink the water. When our water-supply will be available and our sewerage efficient, we may set at defiance even its awfully aggravated and epidemic form. In cabins diarrhœa must always prevail, and typhoid fever and cholera, when introduced, must spread, if there be no efficient means for the removal of refuse,

and if it be allowed to soak around the dwellings and poison the wells and the atmosphere. Gastric fever is a usual pest of the cottager's children, and is produced in the same way.

Of still greater importance is a pure water-supply, yet it is almost universally neglected in Irish towns. The clauses of the Act of 1854 in this respect were very faulty. I am sure that a chemical analysis of the pump and well waters of many Irish towns would disclose facts as startling as those which Mr. Simon published in one of his earlier Privy Council Reports. The Registrar-General's returns had shown that in some English districts the deaths yearly by diarrhœal disease had been eighty times as numerous as in others, and the sanitary inquiry proved that "the excess of mortality had been in all the places coincident with one or other of two definite local circumstances—first, the tainting of the atmosphere with the products of organic decomposition, especially of human excrement; or, secondly, the habitual drinking of impure water. In certain districts of England, sometimes by good fortune, sometimes by good local government, definite causes of disease must have been kept at or near their least conceivable activity; while in other districts the same causes must have been prevailing with as little check as if the community had been one of savages, to whom science had never taught the first and simplest lessons." To show the importance of such questions, I will mention that if the death-rate by diarrhœal diseases had been only ten times the minimum rate, 20,000 lives would have been annually saved.

I will conclude what I have to say upon those zymotic diseases depending upon the introduction of a specific poison into the blood, by mentioning that Prof. Polli of Milan has energetically advocated the use of chemical antidotes to them, orcolytics, as they have been called, such as the sulphites, which are known to possess the power of checking catalytic action. If their curative

efficacy be proved, they will become still more reliable in preventing the specific zymotic process consequent on the introduction of the poison; but I doubt that they can enter the blood, as they are chemically most unstable.

There are a number of skin diseases which belong to the zymotic class, and which are due to the presence of a parasitic animal or plant fixing on the surface. The subject is a full one, and I have only time to mention an example of each class. Itch, due to an acarus, or mite, is communicable very easily from one person to another, or by the wearing of clothes which lodge the parasite. Scald-head is caused by a minute plant, which can be transplanted to the scalp of another. Every person is not inoculable, not affording a fit soil. The disease is rare now; but in the poor-blooded children of the poor it was very frequent for some years after the famine. In foreign climes men are afflicted by other parasites—for instance, the guinea-worm, which burrows under the skin, and a fungus plant, which takes root, and rapidly grows amid the bones of the foot.

On another occasion I dwelt at perhaps sufficient length upon the influence of want of pure air in the production of consumption, which is so potent that the deaths among in-door artizans, such as tailors, shoemakers, weavers, and printers, from this disease are, at least, twice as frequent as among those who labour in the open air.

The inquiries of Dr. Greenhow and Mr. Simon, into the mining and steel-working trades, which I previously mentioned to you, show that the origin of many lung diseases is to be found, not in climatic peculiarities, but in controllable conditions. The irritation of the lungs by organic or mineral particles are accessory causes; constrained positions, want of exercise, and exposure to changes of temperature, subordinate conditions. The influence of ill-aired rooms may depend more on the

particles which float about than on the gases which are confined in it. The disease is becoming very frequent in the factory and linen-working towns in the north of Ireland. Much may be done in the way of prevention both by public and private hygienic measures. Under the former head I include the opening of public parks and grounds, and the preservation of common spaces, thorough drainage of towns, and the selection of good sites for them, the proper construction of streets and houses, a close supervision of the establishments where people work in numbers, and the application of the most scientific preventives to the special injuries which many noxious trades inflict, and in such arrangements our French neighbours far excel us. Among means which lie in each individuals power are the fit ventilation of bed-rooms, to which sunlight should have free access by a proper aspect being chosen, and free exercise in the open air, especially with the habit of filling the lungs occasionally to the utmost, for by ordinary breathing their upper parts are not inflated, and remember a disused organ always suffers. This liability of the top of the lungs may partly depend on the fact, that they are not as fully protected by clothing above the collar-bones as in other directions.

I must mention to you some remarkable facts with regard to the habits of many of those who have afterwards become consumptive—namely, that they have suffered from that kind of dyspepsia in which acid is too freely produced in the stomach, and that they have exhibited a constant dislike for fatty foods. The peculiarity of their digestion would then be, that while albuminous food would be assimilated, the alkalinity of the saliva and pancreatic juice would be neutralized, and their respective functions—namely, the conversion of starch into sugar and the taking up of fat, interfered with. The remedial powers of cod-liver oil, and still more of pancreatic emulsion, which insinuate themselves so readily

into to the absorbents, may depend upon their supplying this want. Dr. Bowditch of Boston has shown that in towns and villages situated in or near undrained localities, or on heavy impermeable soils, or low-lying ground, the greatest number of cases of consumption occurs. This fact is fully sustained by the Registrar-General of Scotland, who shows, with regard to the eight principal cities and towns of Scotland—viz., Leith, Edinburgh, Perth, Aberdeen, Dundee, Paisley, Glasgow, and Greenock, that in proportion to the dampness of their sites consumption prevails. The comparative immunity from this disease in Egypt and the Cape of Good Hope is undoubtedly due to the dryness of the soil and shows the necessity for efficient drainage as an auxiliary to the health of towns and villages.

The proportion of deaths by consumption to 1,000 from all causes was stated by the Census Commissioners of 1851 to be as follows along various parts of the coast of Ireland: north-east from Glenarm to Dublin, 172; south-east from Dublin to Youghal, 161; south from Youghal to Bantry Bay, 106; south-west from Bantry Bay to Galway, 76; north-west from Galway to Donegal Bay, 83; and north from Donegal Bay to Glenarm, 127. The preventives of consumption are urged so enthusiastically by Dr. M'Cormac, that I shall sum up by giving you his list: the respiration of a pure untainted atmosphere by day and night: improvement of the artizan's *locale* and habits, including his bent and sedentary posture—the substitution of steam machinery for dry-grinding and stone-chiselling—attention to the digestive and cutaneous functions—improvements in the aspects of houses and sleeping-rooms—increase of outdoor pursuits—and lastly, full and free respirations in the open air. Dr. Aitken, Prof. of Pathology in the Army School, justly remarks:

"Experience has now adequately demonstrated that the tuberculous cachexia springs from causes over which the public, rather

than the medical profession, have control. The physician must be at once impressed with the belief, and encouraged with the hope, that when he acquires the confidence of the public in the practice of his profession, he may exercise a powerful influence for good, in teaching how much they may themselves control the ravages of consumption by prudent marriages and sanitary attention to offspring. There are several circumstances which show the great influence of public sanitary measures in controlling the ravages of consumption when these measures are scientifically directed to the preservation of the general health, and especially when men are associated together in great communities—an influence much greater than the best directed efforts of the medical profession can establish through their *materia medica*. It is by the mode of life as citizens of the world, in the social relations of husbands and wives, parents and children, and in the public relation of masters and workmen, that the extent and ravages of consumption are to be controlled. It is by a strict attention to the rearing of offspring, and in the subsequent regulation of food, clothing, cleanliness, occupation, the choice of a profession, and by many other circumstances which have an obvious influence (perhaps at first sight inappreciable) on the maintenance of the general health, that our hopes of success as practitioners of medicine must rest, in the prevention of that bad habit of body which develops and propagates the tubercular diseases in civilized society."

Of another constitutional disease, cancer, I have only time to say that local injuries and perhaps inherited tendencies must lead to it, for in unhealthy towns, such as Liverpool, the mortality from it, is not greater than in the whole kingdom.

Upon dietic diseases I made a few remarks on a former occasion, and now, concerning one of them—namely, gout—I can tell you in seven words all the measures which are preventive by quoting Abernethy's reply when asked, what was a cure for the gout? "Live on sixpence a-day, and earn it," for temperance, exercise, and a freely-acting skin are among the hygienic requisites comprised in the aphorism. For it alludes to the excessive amount of food, the alcoholic drinks which prevent the waste of tissue, and the neglected skin which lead to the disease in the individual and his descendants. Similar errors, with the addition of an excessive

use of spices, conduce in a great degree to the liver ailments of the tropical settler.

Of the causes of dyspeptic complaints, I should have a volume to speak, and the way they are complained of. Dr. John Brown puts thus: "If an Englishman is ill, all the trouble is in his stomach; if an Irishman is ill, it is in his heart, and he's 'kilt entirely;' and if a Scotsman, it is his 'heed.'"

As I have endeavored to elucidate, our tissues do not remain permanently ours, but are being in health constantly removed and renewed. Now, when renewal fails, and substances lower in the scale of human chemistry become deposited instead, we give the name of "degeneration" to the condition. The fatty form in which a tissue—the muscular, for example—is either chemically converted into fat, or is removed to give place to that substance, is the most frequent, and chooses such vital organs as the heart, brain (yellow softening), and the kidney (chronic Bright's disease). We are warned that sedentary habits are strongly promotive of this condition, for it was fatal to such prolific writers as Abercrombie, Pereira, and Thackeray, and such industrious lawyers as Cresswell and Slade. The influence of the ingestion of too much heat-producing food to the exclusion of tissue material we have already discussed; but it remains for me to explain the physiological effect of alcohol, which we will find tend powerfully to the production of fatty degeneration. It checks the changes which our tissues are undergoing, interferes with the due oxidation of the blood, or the combustion of its waste material, and, according to many authorities, supplies material itself for the formation of fat, as more certainly does the sugar which most of its preparations plentifully contain. Distilled spirits are for this last reason less promotive of fatty degeneration than other alcoholic liquors. I shall not now dwell on other evils of intoxication, lamentable though they are, save to say that it is not on the indivi-

dual alone they work destructive changes, for his offspring, in addition to moral injury, undergo most manifest physical deterioration. In this way alcohol is one of the most powerful causes of that remarkable character of disease in the nineteenth century—namely, that while the mean lifetime of adults is becoming prolonged, that of children is being most perceptibly shortened. It would appear from some statistics obtained in France, where registration of births has been so long established, that each marriage is followed by an average of two children in Paris, and three in the country parts. In the last century it is computed that the average was five. In the words of Mr. Rawlinson, our leading engineer: "Men live longer and faster than formerly. A man, in these days of steam and electricity, may do more, see more, know more, and, if wise, enjoy more than generations of his ancestors; but he must learn, understand, and obey the laws of sanitary science."

There is another affliction of mankind which I trust may be now considered to be in some degree preventible, and which, with the increase of the means of acquiring knowledge which has been granted to us in this country, will become still more so. I allude to insanity. I must here express my opinion that it is most desirable that lectures on the subject, and the practice in asylums, should be attended by all our students, who must afterwards often come in contact with this disease.

LECTURE XVIII.

THE CHOLERA OUTBREAK, 1866—THE CIRCUMSTANCES WHICH CONDUCE TO THE DEVELOPMENT OF THE DISEASE.

At 11 o'clock A.M., on the 26th of July, one of the City of Dublin Steam Company's vessels landed from Liverpool Jane Magee, a girl aged 16. During the voyage she had been severely purged and vomited, which was attributed to sea-sickness, but she recovered so much, that after having rested at the house of her aunt, 22 City-quay, she spent some hours visiting her friends in that neighbourhood. At about 3 o'clock she became very ill, and Dr. Shanahan (Count de Kavanagh) being summoned, pronounced the case to be one of cholera. She died about 10 that night, and I, having received intimation through the police, examined the body, which presented every feature that cholera leaves behind. I had the windows of the rooms and lobbies opened, and some chloride of lime thrown about the premises; but all my efforts to prevent a "wake" were ineffectual, as they would not believe that the girl had died of cholera, and they did not wish to have the funeral until after the arrival of her mother from Liverpool. On the following morning, with the aid of the coroners, interment was insisted on, and directions were given to the family, with the object of preventing the spread of the disease. Next day I went to Liverpool, for the purpose of ascertaining how she received the contagion, and of observing the type of the epidemic in that city. At 3 Upper Frederick-street, near the river, this girl's mother had kept a lodging-house for sailors, chiefly those from Dutch ports. It was denied

that any cholera had occurred in the house, but the keeper of a warehouse about eighty yards off, in the same street, had died of that disease three days before Jane Magee left, and it was very rife in the neighbourhood. At 7 A.M., on the 30th, Mary Meyler, a cousin of the deceased, aged three years, who lived in the same room, was attacked; this was 91 hours after Jane Magee's arrival in the house. She died at 9 the same night. The third case was that of the father of this child, Andrew Meyler, aged 40, a sailor of rather intemperate habits. He came from sea, on the night of the 27th, to live in the same room. The circumstances of his case were sudden and melancholy in the extreme. While returning home with a coffin for his child (which he had got in Cook-street, where he imported the disease), at 4 o'clock on the morning of the 31st, he was seized with cramps, and in an hour after, when I saw him, he was in hopeless collapse, dying in thirteen hours from the accession of the first symptom of illness. His wife, the fourth and last victim from the room, was seized at 10 A.M., on the 1st August. She could not be persuaded till the following day to go to the hospital; she was then admitted into Sir P. Dun's hospital, and survived till the 5th. After her removal to hospital, the house was completely emptied, and all its premises disinfected, and no case occurred among the inmates, or in the immediate neighbourhood.

The next person attacked was a quay-porter residing in Tennis-court, Townsend-street. He was attacked on 2nd August, and recovered. On the 6th, a fish-woman was attacked at 18 Poole-street, and died in fifteen hours. Her father and child succumbed some days after. She dealt along the quays where the disease was first developed. She was suffering from dyspepsia at the time, and she was of the most filthy habits. Her residence stands on a delta of the Poddle river.

Six other cases, distinctly imported from Liverpool, established foci of contagion before the disease could have been said to have been epidemical.

Except very early in an outbreak in a large city, it is impossible to trace the diffusion of the contagion, a remark which is as true of other diseases universally allowed to be communicable as of cholera.

The last case occurred on the 28th December in Pembroke-lane, where the child died.

The total number of cases at the residences of which disinfection was performed by the Corporation officers was 1,731, but some of them were possibly not cholera, owing to these men acting at the request of any relative—which I trust will be regarded as an error on the right side. I therefore prefer adopting the figures procured by the Registrar-General in the following computations. An accurate return of all the cases attended by Poor Law Medical Officers was returned to the Commissioners, and will be included in their yearly report. Between 26th July, 1866, and 28th December, 923 deaths by cholera within the city were recorded by the Registrar-General, but 52 of these patients, although they died in Dublin hospitals, were brought from districts outside the city, and if they were accredited to these places, they would raise their death-rates very greatly. I have, therefore, abstracted them in the table on next page. The deaths are also arranged according to the weeks in which they occurred, not according to the weeks in which they were registered. The comparative number of deaths by diarrhœa, the mean temperature and the rainfall, for each corresponding week in the last three years, are also given.

I have to thank the Registrar-General, the medical superintendent, and especially the statistics' clerk, Mr. J. J. Wilson, for the accuracy and promptitude with which the returns of cholera and other zymotic deaths have been sent to the Corporation for the last two years.

Week ending.	Cholera.	Diarrhœa.			Mean Temperature.			Rainfall in Inches.		
		1866	1865	1864	1866	1865	1864	1866	1865	1864
May 5		0	1	1	43·0	53·5	52·7	·50	·99	·00
12		3	3	1	52·3	49·5	54·6	·51	·78	·50
19		0	2	1	48·0	53·0	61·7	·06	·18	·07
26		2	4	2	52·7	57·6	54·2	·0	·09	·34
June 2		5	2	0	50·1	54·3	47·5	1·47	1·97	·17
9		5	2	0	56·2	63·7	58·1	·95	·0	·43
16		2	1	0	56·9	58·0	56·1	·73	·0	·28
23		4	3	1	55·8	62·8	57·7	1·64	·14	·68
30		7	4	2	63·4	62·4	56·9	·10	·33	·40
July 7		1	7	1	54·9	63·3	57·3	·95	·69	·0
14		2	9	3	63·7	59·1	58·0	·04	·49	·0
21		3	4	1	61·7	60·5	64·2	·0	·66	·24
28	1	6	7	4	63·3	64·2	62·2	·20	·01	·39
Aug. 4	2	3	10	4	56·7	56·2	59·6	·75	·28	·08
11	5	3	5	7	55·7	61·4	57·4	·90	2·18	·17
18	13	7	9	7	56·7	58·7	57·6	·07	1·06	·04
25	30	8	13	12	61·7	62·4	52·7	·45	·76	·77
Sept. 1	41	4	7	10	57·5	60·9	59·7	·20	·06	·46
8	46	11	10	11	54·9	64·2	57·3	1·05	·08	·76
15	51	9	13	11	54·2	65·2	53·3	1·08	·02	·36
22	66	13	5	13	51·4	55·1	55·2	·62	·0	·51
29	58	7	11	4	51·1	58·4	54·6	·16	·0	·0
Oct. 6	43	8	11	6	54·0	57·9	49·7	·006	·41	·0
13	69	6	10	9	50·2	54·5	50·2	·35	1·48	·05
20	80	13	9	1	51·7	45·1	48·8	·24	·23	3·91
27	80	9	12	2	47·4	47·3	50·0	·49	1·03	2·19
Nov. 3	66	9	9	4	48·3	44·0	45·8	·66	·20	·14
10	73	8	5	5	46·2	42·1	40·8	·39	·09	·19
17	51	8	5	4	44·5	47·3	46·3	·63	·31	1·54
24	45	7	1	4	41·3	44·9	41·3	·09	2·41	·85
Dec. 1	32	7	5	0	42·6	42·0	44·0	·21	1·31	·43
8	12	9	5	4	44·8	45·9	45·3	·77	·89	1·00
15	1	4	5	1	42·0	42·6	41·7	·51	·02	·36
22	4	5	4	4	43·3	47·1	33·4	·25	·01	·97
29	7	6	8	2	45·5	45·3	37·4	·14	1·60	·02

The distribution of the disease over the city I will exhibit to you by a map, and I have ascertained that

it almost exactly follows the course of the water-courses, especially those that have been converted into sewers.

I will now try to explain the circumstances which, I believe, conduce to the development and spread of cholera, taking my illustrations almost exclusively from what I observed during the outbreak in this city. I may be allowed, however, to define the sense in which I use certain words which must be constantly employed. I will use the words "contagious" and "infectious" in no limited sense relating to touch or air alone, but as synonymous with "communicable," or the familiar word "catching." In a more rigidly scientific account, such expressions as communicable by air, communicable by water, &c., might be advisable; but now it would be pedantic to use them, and would lead to needless repetition. To my mind, the word "epidemic" is descriptive of an occasional and extensive disease, from whatever cause it proceeds, and what is implied by "the epidemic constitution of the atmosphere," I do not understand. With respect to cholera, I may once for all say, that I do not think contagion alone will account for its development or spread.

I have for many years considered that the theory of this disease propounded, in 1854, by Pettenkofer, explained its phenomena better than any other I am aware of. Of his excellence as a chemist and physiologist it is superfluous to speak; but I may mention that, like Thucydides and some other historians of epidemics, he has had experience in his own person of the pestilence he describes. His views have gained publicity in England through an analysis of them published in the *Standard*, and an able letter in the *Spectator* by Dr. Rollston, Professor of Physiology at Oxford. In his own words, cholera is neither wholly a contagion nor wholly a miasm, but a bastard of the two. When the two come together their offspring will possess all, and more than all, the malignity of both its parents; but

their concurrence is necessary for its existence, and all persons are not equally liable to its development. That cholera shall therefore arise in a place previously healthy, and attack certain of its population, the following conditions must concur—first, the introduction of the germ of the disease; second, the existence of certain characters of soil; and thirdly, a peculiar liability or "receptivity" for the poison, to which, however, there are some rare exceptions.

I shall briefly discuss each of these three conditions—first—the Germ.

The contagiousness or non-contagiousness of cholera has been warmly debated since that disease left "its home" in 1817. The ablest men in our profession have been ranged on one side or the other, and victory seems to have vibrated between the disputants. In 1832, all were contagionists; in 1849, nearly all held the contrary opinion; and after 1866, a medium view will be established. Probably no error in sanitary matters was ever so fatal as that of the Metropolitan Sanitary Commission of 1848, which included Lord Robert Grosvenor, Mr. Chadwick, Dr. Southwood Smith, Prof. Owen, and Mr. Jones. All their acts were directed according to their conviction, "that there is no evidence that cholera spreads by the communication of the infected with the healthy." The instance they regard most triumphantly is Birmingham, which, although but seven miles from Bilston, where the disease raged violently, was almost free. However, a few cases did occur along the canal, which was the chief medium of communication with Bilston, and I think the reason for the exemption of the rest of the town is contained in the following words of the Commissioners: "Birmingham is built for the most part, high and dry, on a most absorbent red sandstone." Others of their conclusions were, however, most just, and the greatest advantage flowed from them.

Mr. Kirby published a very able address to our citizens on the 18th June, 1849, in which he says: "If in the dispensations of Providence it be so ruled that my house shall be visited with this disease, I purpose to act upon the conviction of its contagious character. As in typhus, the sick shall be insulated from the rest of the family, due ventilation, cleanliness, and quiet shall be observed, while nothing shall be given either in diet or in medicine save as skill directs and under the administration of proper nursing attendants." There being any doubt, it was wiser to have acted on the possibility of its spreading from person to person,

> "And we all know security
> Is mortal's chiefest enemy."

Pettenkofer asserts that the germ is formed by and in the excreta of cholera patients, and by and in those persons who may have not been actually seized by the disease, but have been living within the sphere of its devastations, wheresoever such excreta are left undisinfected. Among many others, he gives the following clear case of importation. A lady travelled for nine days, from Odessa, where there was cholera, and where her child had diarrhœa, to Altenburg. Within hundreds of miles of this town, there was no cholera. She died of that disease on the fourth day of her arrival. Her sister died on the following day, and the disease spread from this house, in which they both lived, throughout the town.

Dr. Barrant has recorded instances of coolies coming from infected districts, themselves apparently healthy, giving cholera to newly arrived coolies at the Mauritius.

I conceive that the development of the outbreak in Dublin, which I briefly sketched in the beginning of this lecture, points to the conclusion that a germ is necessary, and that "spontaneous generation" is as untrue of cholera as of organic life. Dublin was re-

markably free from diseases of a similar type—diarrhœa or typhoid fever—0,3,0,2,5,5,2,4,7,1,2,3 cases of the former disease, in a population of 254,808, having been respectively fatal in the twelve weeks prior to the importation of the cholera-germ on the 26th of July. The same story for other districts in this country is told in the following words of the Registrar-General on the 2nd November: "About thirty Registrars reported cases of cholera having occurred in their districts. In nearly every instance those who were first attacked by the disease had been recently in localities where cholera abounded."

Dr. Floyd, F.R.C.S., has traced the introduction of the contagion into Edgeworthstown by the body of a child, who died of cholera in Longford, being left in the grave-yard unburied, owing to the drunkenness of the grave-diggers. Three children endeavoured to open the coffin, and were nine hours after seized with fatal cholera.

In Belfast the circumstances were detailed with great exactness by Prof. Reid. Into Arklow it was introduced by a sailor from the *Crystal Palace*, a vessel which came from Liverpool to Dublin, where one of its crew died of the disease. The ship having arrived at Arklow, one of the sailors resided in the town, and in two days was seized with cholera, from which he recovered, but the disease spread with great rapidity in the immediate neighbourhood of his residence.

The Rev. Prof. Haughton has collected many facts which support the contagion theory, and every case in Ireland can be traced back to three British centres. Into Parsonstown it was carried from Sheffield, into Wexford from Cardiff, and the other twenty-three Irish towns either directly or indirectly imported it from Liverpool. Now that Westport and Tralee are within eight hours of Dublin, cholera can make much more rapid strides than it could in 1849. Drogheda

and Dundalk, Dr. Haughton thinks, received the germ by sea from Liverpool, and Portaferry in a fishing-boat from Balbriggan. He tells me that the Rev. Dr. Lloyd, who is accustomed to the logical exactness of the physicist, has satisfied himself that contagion is necessary for the development of cholera.

The cholera map of the Commissioners of Health, drawn to disprove the contagiousness of cholera, requires notice from me, considering the eminence of those authorities. Most of the free towns on it I find were distant from rivers, or high above those which had a great and rapid volume of water, and many of them were away from the greater lines of traffic. Many of the towns attacked were along the canals, which being then the means of travelling from Dublin, brought the disease to them, while these sluggish bodies of water promoted its development, as I shall afterwards tell you. The northern and eastern towns escaped better, as their sewerage and sanitary state was more decent, while Connaught towns, unsewered and filthy, and overcrowded with wretched, half-starved people, suffered fearfully. The density of the people was more than one-third greater than in Leinster, notwithstanding the inferiority of the soil, and the people were more limited to the potato as a diet than in other provinces. In Connaught that root failed more than elsewhere; and in 1849 the Rate-in-Aid Act was passed for 22 unions, 14 of which were in Connaught, and 6 in Munster; and, in the words of Sir G. Nicholls, "they stood in much the same relation to the other unions in Ireland as a pauper stands in towards the independent labourer." As I mentioned in a former lecture, although many of the hovels of this province are swinish, not human, the landowners of Galway, Mayo, Roscommon, and Leitrim have never borrowed money from the Board of Works for their improvement. The reapers, who go in greater numbers

to England from this province than from any other, imported the contagion. Scarcely a Connaught town had adopted improvement acts, and there was a great dearth of fit hospitals. In 1830 Lord Monteagle's committee reported that many counties in this province had omitted to provide fever hospitals. Two unions in this province had guardians so refractory, and so careless of the interests of the poor, that in 1845 they had to be dissolved by law; and in 1847, of the 32 boards of guardians dissolved, 14 were in Connaught. Sir D. Corrigan, in his re-issue of this publication, appeals to the facts that the cholera matter has not been isolated; but in the case of that contagious malady upon which he is the greatest living authority, typhus, he must confess the same imperfection of our means of research. There is, however, much evidence to show that the bowel-discharges contain the cholera poison. Dr. Alderson (*Lancet*, 12th Jan., 1867), quotes French experiments, in which choleraic symptoms were produced in dogs, if the excreta of cholera patients were given between three and six days after ejection. In experiments just made by order of Mr. Simon, mice were thus given cholera. In India monkeys have taken the disease. The fact of a medical man sleeping in an hospital bed from which a cholera patient was removed, supplied only one of the three conditions which I believe are necessary for the development of the disease.

Sir D. Corrigan quotes from Hecker's work a description to show the horrors which would accrue from a belief in contagiousness. This account, which is from Boccacio, refers however to the Black Death of the 13th century, in Florence, when the people were grossly ignorant, and so barbarous as to murder many thousand Jews, under the allegation that they had caused the pestilence. I think, however, that a general alarm would be most likely to arise from the belief that cholera was an atmospheric, and therefore unavoidable scourge, whereas

the conviction, that it was the most preventible of maladies (of which I am fully convinced) would reassure many and save life.

I understand, however, that at the meeting of the College of Physicians, Sir Dominic, with that large-mindedness which so eminently characterizes him, acknowledged that he was convinced of the contagiousness of cholera by the proofs the Rev. Dr. Haughton produced.

In both former epidemics it appeared first in Sunderland, being carried from northern Europe; but in 1865 it was imported into Southampton direct from its Eastern habitat, because in the meanwhile the rate of transit had been quickened.

Cholera being then communicated by a specific poison emitted from a patient already attacked, therefore follows the lines of human intercourse for the most part; but outbreaks do undoubtedly occur which allow of no such explanation. During the first outbreak it appeared first in Dublin on 22nd March, 1832, and arose in Cork on 12th April, probably from some new source of contagion (perhaps by the steamer which then plied between these cities), for Naas, which lies along the direct road, was not attacked till 13th April.

Cholera breaks out yearly in Japan, having been first introduced by an American ship. It carried off, it is said, 200,000 from one city (Yeddo), which is probably destitute of sanitary improvements.

Australia, which is so many days' voyage from foreign ports, has never experienced the disease.

The reliable reports which are annually published by the Army and Navy Medical Departments contain hundreds of instances showing that cholera is communicable. That by Dep.-Insp.-General Barrow, relating to the ill-fated ship *England*, is incontrovertible. I can only read you a paragraph: "Here was a ship fearfully overcrowded with emigrants, in a most filthy condition, and with the

germs of cholera within them, which soon burst into activity, traversing nearly 2,000 miles of ocean, and in twelve days arriving at Halifax, N.S., a healthy city, where cholera had been unknown for many (over 30) years. Two pilots when towed astern of the ship in question, having never been on board, in two or three days contracting cholera, one of them dying, and both transmitting the disease to their families, living at a distance of ten miles from the infected ship—one other family only being attacked, through the medium (with scarcely a doubt) of infected bedding."

It is fair to state that in the report immediately following, by my former pupil, Assistant-Surgeon W. T. Martin, there is the following fact: 75 cases occurred at Neemuch among the soldiers of the 45th regiment, while "not one single native attached to the regiment showed the slightest sign of cholera—a strong argument against the doctrine of contagion," or rather in favour of the additional element of receptivity being necessary—for he adds: "The Europeans attacked were, with very few exceptions, in a weakly state of health."

The story of the *Helvetia*, as told by Dr. Trench, is full of interest. Several German emigrants appear to have carried the cholera germ with them, and forty of them lodged in a room containing but 5,493 cubic feet, in an hotel which, by the possession of a spirit licence, eluded sanitary inspection. The vessel sailed on 2nd May 1866, and during the following day the disease appeared among those who had lodged in this hotel. The authorities at Queenstown having refused a refuge for the vessel, she returned to Liverpool.

"How far the selfish precautions of the officials of Cork," says Dr. Trench, "were legal is a question well worthy the consideration of the central government; but there can be no hesitation in arraigning them, upon their act, as guilty of inhumanity and of a reckless disregard of the duties of charity and hospitality. Nor ought the power thus to deny to the passengers of an English ship, stricken with sickness, the help which even the tyranny of a

Turkish or Spanish quarantine affords to the stranger, be permitted to pass unquestioned for the future. Apart from the cruelty to the passengers and crew, some weight was due to the fact, that in the neighbourhood of Cork there are open spaces, and even islands, where the emigrants might have been safely lodged in tents, without danger to themselves or the inhabitants of the town, until the ship had been cleansed, disinfected, and prepared again for sea; while to send them back to the Mersey was to bring the risk, almost the certainty of deadly contagion among a crowded population of half-a-million of souls."

The disease thus thrown back upon Liverpool produced fearful havoc, and as it was from that city that this country has been infected, there has been something like retribution for the act of which Dr. Trench complains. The Dutch and German passengers of the *Helvetia* were almost exclusively attacked, the British emigrants not having acquired the condition conferred by residence on a peculiar soil.

In 1848, the disease was clearly imported into Liverpool from Dumfries.

The Council of the Epidemiological Society conclude, after an analysis of the replies received to a circular sent to various authorities, that cholera is communicable, that therefore mixing its victims with other patients in hospitals is wrong, but that with precautions they may be admitted to special wards. The forty-two replies may be arranged as follows:—For special hospitals 19, including every naval and every military authority but one, and nearly all those who have made hygiene and the laws of epidemics objects of special study; for special wards 12, including some distinguished sanitarians and practical physicians; and for the mixing of cholera cases with ordinary ones 10, headed by Sir D. Corrigan. Those who object to even the admission of cholera patients into general hospitals at all, have an equally distinguished leader, Sir Thomas Watson. One reporter would have those attacked, treated exclusively at their homes. The communicability of

cholera is allowed in almost every one of the answers received.

Although my humble opinion is counted in the list of those who advised special hospitals, I have been since converted to the medium view, for I think that the advantages of the administrative superiority of an established hospital outweighs the risk by contagion.

I think the experience gained during the last epidemic will probably lead to the separation of cholera patients from others in the hospitals of this city.

That the germ of cholera was imported from India into Egypt and neighbouring countries, was demonstrated by Dr. Fox, and afterwards by the cholera conference; so that the first-named country is still happily its only "home," as Siberia is of the cattle-plague; and we must fervently pray that neither will become endemic as small-pox, once a foreign visitor, has done. The great conference at Constantinople reported that the permanent settling of cholera in these countries was possible.

Mr. Radcliffe, the Secretary of the Epidemiological Society, in his report to the Privy Council, gives instances of infection in the Eastern world too numerous to mention, and there it seems to run a shorter but more fearful course than in these kingdoms, the disease quickly finding out the susceptible subjects. The exclusion of pilgrims from Mecca, a rigid quarantine against them, or the enforcement of habits of cleanliness among them, might break the chain of infection.

From a comparison of the last with previous epidemics, I am convinced that cholera will be a more frequent visitor, and our safety lies in sanitary work which will, with positive certainty, render its attacks less formidable.

There are many instances where no communication with the sick can be traced, but the same must be said of small-pox and other diseases acknowledged on all

hands to be communicable. The germ may be reasonably supposed to spread by the sewers, into which it may be readily introduced, or by the water stratum in undrained localities.

That learned physician, Prof. Aitken, relates the following exceptional case: "In one of the Western Islands, the most remote from the mainland, the disease suddenly appeared, where so little intercourse existed with the place that the clergyman of the island continued regularly every Sunday for eighteen months to pray for King William IV., as if he had been alive, after our gracious Queen Victoria had ascended the throne."

The sudden outbreak in the Mountjoy Prison is truly inscrutable, and the medical officer, Dr. R. M'Donnell, notwithstanding the complete powers of research he possesses, has not been able to offer any explanation. The water-supply is that of the north of the city, renewed in a tank every twenty-four hours, and the sewerage seems most excellent. The canals surround it on two sides, being but 200 feet distant, and its high level is many feet above the basement, but all the cases occurred in upper storeys. A still more inexplicable case is given by Prof. Christison (*Brit. Med. Jour.* 5th Jan., 1867), in which the peculiar soil was present, but the existence of a germ most improbable.

Dr. Brassington of Rathmines lately reported a case in which a boy and his mother were attacked and died, yet another child which she suckled after the development of the disease escaped. This case proves, at any rate, that some are insusceptible, and that the contagion is not communicable through the mother's milk.

Now, with regard to the media of infection.

In my lecture on water, I brought forward some evidence of the communication of cholera through water, especially the famous cases of the Broad-street pump, and the water of the Southwark Company; but

it may not be inappropriate to add to it on the present occasion. Many cases admirably reasoned out may be found in the great work of the late Dr. Snow. The grandest case of the late epidemic is that of the east of London, in which 3,909 persons perished during the twenty-one weeks of the outbreak. The district is supplied by the water of the river Lea, into which sewage pollution has been clearly traced. The mortality in various sub-districts was proportional to the amount of them supplied with this water. That it was not thoroughly filtered is shown by the fact that eels and bushels of bivalves have been removed from the pipes and tanks through which it had passed. The distribution of the cholera and of the water of the Lea has been thoroughly investigated by Dr. Farr, and their coincidences could not be merely fortuitous. Every medical officer of health, except Mr. Orton, concurred in the opinion, and nearly every one of these gentlemen was able to trace the first attacks to communication with infected districts. Not one of them appears to be an anti-contagionist.

The Registrar-General on 24th November published a painful case, showing conclusively that twenty inmates of a fashionable lodging-house at Margate were seized with cholera, a London visitor having imported the contagion, which was distributed by the well.

Of the severity of epidemics being lessened after an improved water supply, I could give many instances. Newington district, London, in 1849 and 1854, was supplied with water from the Thames, proven to have contained sewage. The cases of cholera in these years were 907 and 694 respectively. Since then a purer supply has been obtained higher up the river, and in the late epidemic the cases were 24.

In Swords, a little town of some 1,400 people, 65 cases of cholera occurred in seven weeks. The water supply was from an unprotected well, subject to great

defilement, as I witnessed. There was the greatest difficulty in isolating the patients or getting them to go to hospital; but as brandy was given out, there was no difficulty in ascertaining when and where the cases arose. The sanitary state of the place has been greatly bettered owing to the representations of Dr. Davys.

In the village of Crumlin, out of 165 inhabitants, 46 were seized with cholera and choleraic diarrhœa. A single and most superficial pump is the sole water supply, and its produce was stinking, and often muddy, as Dr. R. P. White informs me.

Kingstown suffered far more than Dublin in proportion to population, and at least one of the promoting circumstances is a wretched supply of water, exclusively by wells. After two cases of cholera, one of which was fatal, had occurred in the house of a friend of mine, which is situated in one of the best parts of that town, he poured a quantity of carbolic acid into the sewer, and found that the water of the adjoining well tasted of that substance for many weeks after. It is almost certain that the sewage had in the same way percolated before the appearance of the cholera. The granite stratum over which the town is placed renders drainage very difficult. I have since seen that the same test for sewage contamination has been observed at Oxford; and Dr. Madden, in the excellent essay which he has written on the epidemic in Kingstown, has given another similar instance. The rate in Kingstown was over twice that of Dublin, and higher than that of East London. Although the disease began two months later than in Dublin, the weeks of greatest mortality were the same—the 20th and 27th of October.

From the researches of the late Dr. Snow, who originated the idea that cholera was spread by the water used for drinking, I select two instances—the one to show the decrease of cholera following improved water

supply; the other, its increase when the quality of that necessary is deteriorated. The cases of cholera in Exeter in 1832 exceeded 1,000. The water supply was by carriers from the river, into which all the sewage flowed. Before the next visitation which devastated the country, the water was taken from two miles above the town, and in 1849 but 44 cases occurred, and in 1854 hardly one. Hull, in 1832, was supplied with pure pipe water, but so scantily, that the poor had to resort to other means to procure it; 300 people, mainly the poorest, died of cholera in that year. In 1844 a supply was abundantly procured for all classes, but from the river; and accordingly, in 1849, 1,834 persons from all ranks fell victims to this ignorance or negligence of the poisonous effects of contaminated water. It is remarkable that Sunderland was the first town attacked, both in the epidemics of 1831 and 1848, being the nearest port to that part of the Continent where the cholera was raging.

What has been proven of cholera may be just as true of many intestinal and other diseases, and must surely awaken communities to the vital importance of water pure and plenty. I cannot refrain from reading for you Shakespeare's description of blood poisoning, as it is consonant with the modern view of the action of the cholera matter:

> "Whose effect
> Holds such an enmity with blood of man
> That, swift as quicksilver, it courses through
> The natural gates and alleys of the body;
> And with a sudden vigour it doth posset
> And curd, like eager droppings into milk,
> The thin and wholesome blood."

Early in the summer of 1865, cholera was decimating Cairo, and many of the authorities reported in their despatches that the water of the river from which the people were supplied was, during every hour of

the twenty-four, polluted in a manner too nasty to mention. In its population, 282,348, the greatest mortality on any one day was 468, but in 1831 it was 2,500. The *Medical Times and Gazette* reports a case of a "man who jumped into the Thames and put an end to himself, and though he was rescued from drowning, yet died in Bloomsbury—an isolated case from cholera," three days after.

When water is scanty, that kept in the sick room may possibly get infected from the patient first attacked.

Another means by which the poison may gain entrance into the human body is from the hands of those who have tended the sick, or on the drinking-vessels which have been used by them for other purposes. Such a case is detailed by a most able writer in a recent number of the *Social Science Review* (edited by Dr. Richardson), wherein it is also stated that an assistant in the cholera hospital at Berlin produced cholera in himself by tasting the excreta of a cholera patient, and that the symptoms were induced within six hours.

The clothes of some cholera patients, who had been in the Meath Hospital last August, were sent to be washed by a woman residing in Chamber-street, where the disease had not been previously, and in three days she was seized with cholera, which proved fatal to her and to a man residing in the same house, and spread extensively in that street, which is built along the Poddle.

If spread by these media of direct personal communication, its progress would be much more slow than unfortunately it is. We must, therefore, seek some other channels.

I do not think a reasonable doubt can be entertained, that cholera is a malady produced by the entrance of a poison into the human body, the digestive canal being the site upon which it specially fixes. Whether such

poison is gaseous or suspended in the atmosphere—whether it is an organized body, vegetal or animal, we know not; but if the latter supposition be true, we can believe that, like the pus cells in the eye-ward at Prague, it could be carried through the air without injury to its communicable power, and that if dried, like hosts of vegetal germs, it might regain its power by moistening on our mucous surface. If caught by the surface of the mouth or nostrils, it would be swallowed, and thus reach the digestive canal, if that be the only habitat where it can develop. There is abundant reason for regarding the white flocculent matter from the intestines as the morbific material, and I think the fact lately determined by Dr. Frankland—namely, that this stuff passes through the charcoal, and even the German paper filters, indicates, besides extreme minuteness, an organised nature, for if a chemical compound, it would be in all probability changed by oxidation during the process. Dr. Richardson regards the poison as probably an alkaloid; and Bence Jones, our ablest physiological chemist, thinks that another zymotic ague may depend on the want of the alkaloid quinoidine, which he discovered in the human tissues.

There can be no doubt that fever, scarlatina, and measles far exceed cholera in infectiousness—that is, in their power of being transmitted through the air, and this fact has led many to the general conclusion that cholera was not catching at all. The immunity of hospital attendants is often appealed to, but they are pro tected by peculiarities I will afterwards mention, and if the necessary characters of soil be absent, the disease cannot spread. The aerial diffusion of the specific germ will account for the wide spreading of a diarrhœal tendency at cholera periods, and the dilution which such a mode of conveyance necessarily implies, accounts for its impotence or mildness in the vast majority of cases. The diffusion of the same germ in drinking water se-

cures the impregnation of the system with a much larger dose of the poison than can ordinarily be inhaled by the lungs from the air around us; and in this way can be explained, by the light of Pettenkofer's views, the enormous fatality which has followed upon such comtamination. The effects of a concentrated are different from those of a diluted poison, and the cubical space of the air we breathe being out of all proportion larger than that of the water we drink, the dilution of an aerial is likely to be enormously greater than that of a potable poison.

We are ignorant whether the cholera germ can survive extensive transport in the atmosphere; but if it can, we can easily believe that it may spread far and near, remembering that sand has been blown away many hundred miles from the African coast.

The safety which, by disinfecting the excreta of the first cholera patient, we insure is as great as that which a complete quarantine, if at all attainable, would have secured, or as that which a dry, non-porous and unpolluted soil confers. In the language of Prof. Rollston:

"The otiose scepticism which is content to deny and disbelieve, overtly and genially enough, everything which it has not chosen to examine into becomes, at a crisis like the present, simply a public offence. There is a larger and less amusing class of men whose minds are just active enough to make them good at objections, without making them good at anything else. On the present, as on most other occasions, such men content themselves with making suggestions in the helpful negative shape familiar to them, and they warm into sympathy with investigation only, so far as they hope to see our present means for doing good superseded in the progress of discovery, and those who have availed themselves of such imperfect light as they could at the time obtain, discredited thus as clumsy bunglers. Such persons are more powerful just now than under ordinary circumstances for provoking anger; in a population which knows itself to be mortal they are, fortunately, less powerful for producing mischief."

The conclusions of Mr. Simon, that able pathologist whom England is so fortunate as to have at the head of

the Public Health Department, are so forcible, that I shall give them to you verbatim.

"That when the cholera is epidemic in any place, persons who are suffering from the epidemic influence, though perhaps with only the slightest degree of diarrhœa, may, if they migrate, be the means of conveying to other places an infection of indefinite severity; that the quality of infectiveness belongs particularly, if not exclusively, to the matters which the patient discharges by purging and vomiting from his intestinal canal; that these matters are comparatively non-infective at the moment when they are discharged, but subsequently, while undergoing decomposition, acquire their maximum of infective power; that choleraic discharges, if cast away without previous disinfection, impart their own infective quality to the excremental matters with which they mingle, in drains or cesspools or wherever else they flow or soak, and to the effluvia which those matters evolve; that if the cholera contagium, by leakage or soakage from drains, or cesspools, or otherwise, gets access, even in small quantity, to wells or other sources of drinking-water, it infects in the most dangerous manner very large volumes of the fluid; that in the above described ways, even a single patient with slight choleraic diarrhœa may exert a powerful infective influence on masses of population among whom, perhaps, his presence is unsuspected; that things, such as bedding and clothing, which have been imbued with choleraic discharges, and not afterwards fully disinfected, may long retain their infectious properties, and be the means of exciting choleraic outbreaks wherever they are sent for washing or other purposes."

He details the almost insurmountable difficulties of establishing a complete system of quarantine, but shows, that even partial isolation of infected persons from cholera and other communicable diseases, is called for on the part of local authorities. The power is fully conferred by the Sanitary Act, 1866, and the Orders in Council based on it.

At the Sheffield meeting of the Social Science Association in October, 1865, Dr. Trench said: "I tremble when I think of the danger to which we are exposed in Liverpool should a vessel arrive with cholera on board. I have no power to prevent a person affected with cholera being brought into the midst of that large community, and spreading the disease on every side."

The second concurrent circumstance is terrestrial. As far as I have been able to ascertain, the same streets in this city which have been lately attacked, were those which suffered in the two previous epidemics.

In 1833 and 1849, the first cases occurred in Berlin, Hamburg, and St. Petersburg on the same side of the same street, and in some instances in the same houses of these respective cities. Similar facts have been noticed in a number of towns in England, and in many places in America. In the city of New York, endemic cholera, in 1832, 1849, and 1866, commenced near the same spot, and ravaged in all these years the same localities that remained in 1849 and 1866 in the condition they were in during the year 1832.

There must be therefore some peculiar local condition. The local miasm-producing condition, according to Pettenkofer, is the existence of a porous soil impregnated with human excreta, not necessarily choleraic, and overlying springs at no very considerable depth. The most favourable time for the specific excitant germ to be received into such a locality is when the springs have just sunk unusually low after having been unusually high; or when hot dry weather succeeds rainy weather, the rain would raise the subsoil water, and when it sank during the drought, the high temperature would promote the decomposition of the organic matter it had left behind. Dry weather would open the surface earth and allow exhalations to issue, or moist weather, by lightening the air, would allow their ascent. Foul places always smell worse in damp weather. The symptoms of cholera most frequently appear about midnight, when miasms, "the infections that the sun sucks up," arise. There is no inaccuracy in this notion of our great poet. It may be that there is some periodicity about cholera, the offspring of animal malaria, as there is about ague, which is due to vegetal miasms. If so, the giving of quinine by injection under the skin (for

all other ways of using medicines are futile) may be of benefit. If the excreta of cholera patients, or of persons who have resided in a cholera district, their own want of susceptibility having protected themselves, are brought into a locality devoid of the peculiarities just detailed, no propagation of the disease will take place; and *vice versa* if, into such a locality as above described, no specific choleraic germ is introduced, no cholera will ever arise within its precincts, though they be reeking with every other human pollution.

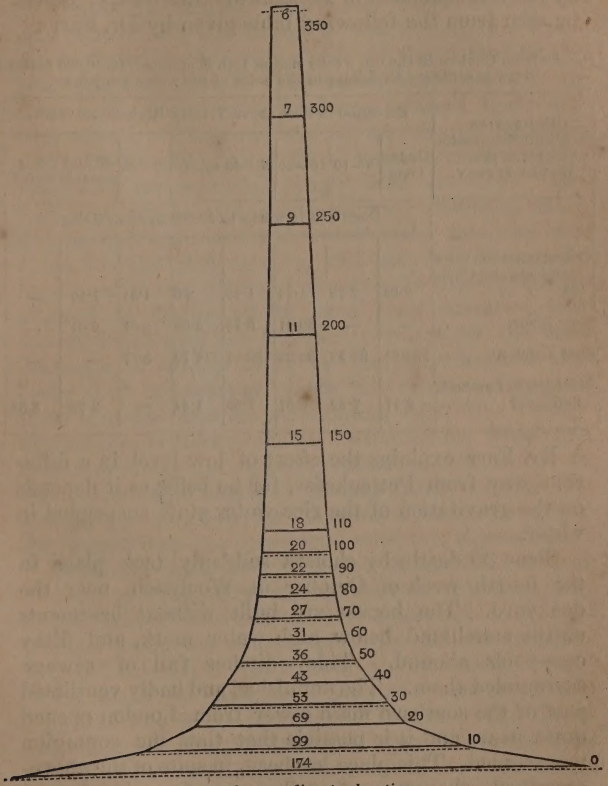
The two best cases in illustration of the indispenpensable presence of a porous, moist, and impure subsoil which Pettenkofer gives are as follows:—The transport ship *Carnatic* was lying off Madras waiting to embark troops, whilst an epidemic of cholera was raging there. In the mean time, the sailors were as usual allowed their liberty days ashore, on a soil predisposed and amidst a population succumbing to this disease. The troops for which the transport was waiting, on coming down to Madras from an uninfected inland country, were by a well-informed commanding-officer, marched right through the town, without halting in it, and the ship put to sea. After seven days the cholera broke out among the sailors, but though they were nursed by the soldiers, they communicated the disease to none of them, the contagious factor of cholera being present in abundance, but the peculiar soil for the production of the miasmatic condition being of course absent. In like manner, the sailors in Admiral Dundas's flag-ship *Britannia* fell ill, 16 days after leaving Varna, with cholera of a most virulent type, and though so great mortality took place on board that they were compelled to supply themselves with additional hands, from an uninfected ship which they fell in with out at sea, and to transfer some of their own sick to it in return, not the least communication of the disease to the fresh ship's crew took place. Sir William Burnett's so-

lution of chloride of zinc was, however, no doubt, freely used in both these casesfor disinfection. According to the writer who has given us Pettenkofer's great essay in an English dress, "these histories furnish us with satisfactory means for reconciling the contagionist and non-contagionist theories; and what is of practical moment, they show us how we may secure for ourselves, in dealing even with cholera, a certainty and an assurance which we can never hope for in dealing with the less virulent, but more purely personal and contagious maladies—scarlet fever, typhus, and small-pox."

The computations of Dr. Farr, the Registrar-General's Department, in his exhaustive report on the epidemic of 1849, in England, conclusively showed that cholera was essentially a disease of low levels from which sewerage is with difficulty drained off. This diagram, copied from that in the report, exhibits the number of deaths by cholera to 10,000 inhabitants which occurred in London at various levels above that of the Thames, marked in feet at the side of the pillar. The dotted lines indicate by their length the mortality observed, and the unbroken ones that obtained by calculation of the level, and you see how closely they correspond:

In short, you see it was a "low-level" disease. The deaths on the level of the Thames were 174 per 10,000 inhabitants; 10 feet higher the deaths were only 99 per 10,000; at 20 feet they were 69, and at 100 feet only 20 per 10,000. Up to the highest observed altitude—350 feet—this law of decrease continued, the proportion at the top of the scale being only six per 10,000. But the variations are most striking at the foot of the scale, the first ten feet making a difference of more than 70 per cent. in the deaths, in comparing the higher level with the lower. That this slight difference, scarcely more than the height of a man, should have such a potent influence as to make

99 deaths in the one case 174 in the other, is a significant fact depending on the extreme difficulty with which a place at sea level is drained or rendered wholesome.



Deaths according to elevation.

The only exceptions to this rule were occasioned by peculiarities in the local water, for where this was foul,

not even the altitude of their situation saved the people from the ravages of the disease.

The qualification I have just mentioned was shown by the late epidemic in London to be necessary, as will be seen from the following table given by Dr. Farr:

Deaths from Cholera in the ten weeks ending 15th September, to 10,000 persons living at different elevations in the fields of the water companies.

Companies furnishing the greater part of the Water Supply.	Elevation in Feet above Trinity High-water Mark.							
	Under 3 feet.	3—10	10—20	20—40	40—60	60—80	80 and upwards	Not stated
	Deaths in 10 weeks to 10,000 Persons living.							
Grand Junction, West Middlesex and Chelsea	2·04	2·75	1·74	1·16	·86	1·51	1·10	—
New River ..	—	—	39·47	9·15	4·00	2·01	2·61	—
East London ..	192·65	90·32	90·22	63·47	14·73	3·67	—	—
Southwark, Lambeth and Kent ..	2·77	7·82	6·67	1·69	1·34	—	2·28	3.34

Dr. Farr explains the effect of low level in a different way from Pettenkofer, for he believes it depends on the gravitation of the rice-water stuff suspended in water.

Some 30 deaths by cholera suddenly took place in the fourth week of October at Woolwich, near the dockyard. The houses are built without basements on the marshland below high-water mark, and filthy cess-pools abound. Tidal ditches full of sewage surrounded them. The unfinished and badly ventilated part of the southern main sewer from London opened quite near, and it is possible that thus the contagion was carried. This place has been, in spite of the above-described characters of soil, very free in former epidemics. The rest of the neighbourhood remained unusually healthy.

Suspecting that there was a close relation between the prevalence of cholera and the presence of water-courses in a neighbourhood I marked on a modern map of Dublin the streams which are traced on Speed's map (A.D. 1610), and Rocque's map (1756), and afterwards dotted in the spots where all the deaths by the late epidemic ensued. The result surprised me, for there is the closest correspondence between these circumstances. Three-fourths of the deaths occurred within 200 or 300 feet of these water-courses, and the remainder are scattered singly over the city. The fact of a single case only occurring indicates more than an entire absence of the disease, the salubrity of a place, for the cholera germ did not find favourable local conditions. Some of the streams here have been allowed to fill up, others have been converted into sewers which may not sufficiently carry off the land drainage, or which being of the flat-bottomed and leaky kind constructed in the last century, may pass their contents into the surrounding soil. The former explanation is more probable, as the canals which are free from sewage, promote the disease as completely. It cannot have been that these streams distributed the cholera germ as they flow, for the dates of the appearance of the disease does not correspond with this supposition.

By this fluviatile theory, the travelling of cholera from Moscow to Petersburg, was at one time explained, but as Dr. Graves remarked, no river could flow thus, "as if water attempted to accomplish the alleged journey, it would have on the way much up-hill work."

There are few cities more completely encircled and intersected by water-courses than Dublin. The Royal and Grand Canals, or ditches of stagnant water, form a circle very nearly complete round it, the only break being between the docks at James's-street and Broadstone, a distance of about a mile—along high ground, too, which would throw water back.

The Liffey runs through nearly the centre of the city, and if its low level makes it improbable that it induces an understratum of water in its neighbourhood, it contributes to the production of cholera by the stagnation and rotting of the sewage cast into it. The returning tide carries back any sewage which may have flowed seaward, and saltwater encourages its putrescence. The minor streams are—the Poddle, which, entering the city at Dolphin's-barn, divides into many branches, and flows through the entire of the south-western quarter of the city, and communicated with the ditch round the old walls of the city. Another stream, probably the Tongue, which Provost Baldwin directed from the Dodder at Clonskeagh, flows through Camden-street, Upper Mercer-street, and Clarendon-street, to open by a smaller branch into the Liffey at Aston's-quay; and a larger one runs across Grafton-street (where, by its bursting, a woman was drowned in a kitchen) towards Townsend-street and George's-quay. Another watercourse is traced on old maps at Baggot-street, Hamilton-row, through the College-park (where it is remembered as the Haha), and Shaw-street, to join the Liffey at City-quay. The Camac, arising near Rathcoole, courses through Kilmainham, Bow-lane, and Watling-street to the Liffey. The sewage of the Richmond Barracks flows into the river, and the nuisance thus created is at present the subject of litigation. It formerly bounded Usher's-island on the south. On the north-side, the Bradogue entering at Grangegorman, passes through Bolton-street, Boot-lane, and Arran-street, to open at Ormond-quay, and a stream is traced in Rocque's map passing from Phibsborough, across Eccles-street and Dorset-street, to join the river just named. On the same map, there are pools figured at Gregg's-lane, Mabbot-street, Earl-street, Ellis's-quay, Island-street, and City-quay, just where cholera lately raged. The following is a list of

cholera fields along these watercourses, each having a radius of 440 feet :

Water-course.	Centre.	Deaths.	Elevation above High water
			Feet.
Bradogue ..	Green-street ..	21	31
„ ..	Boot-lane ..	31	25
Camac ..	Old Kilmainham ..	12	50
„ ..	Bow-bridge ..	7	40
City Basin ..	James's-street ..	17	70
Coleman's Brook	Wormwood-gate ..	29	24
Grand Canal between ..	Huband and M'Kenna bridges ..	12	36
Poddle ..	West-end of Coombe..	23	51
„ ..	New-Row, south ..	24	45
„ ..	Ross-lane ..	21	40
„ ..	Chancery-lane ..	25	50
„ ..	George's-court ..	8	30
„ ..	Essex-street, east ..	7	25
Old Stream ..	Montagu-court ..	25	50
„ ..	Coppinger's-row ..	13	28
„ ..	Shaw-street ..	42	18
„ ..	Church-street ..	17	30
„ ..	Strand-street, little ..	11	19
„ ..	Strand-street, great ..	11	19
Royal Canal ..	Campbell-row ..	10	41
„ ..	Newcomen-bridge ..	10	25
„ ..	Guild-street ..	9	19
Tolka ..	Ballybough-bridge ..	14	20

There were others too numerous to mention. In fact, there were very few cases, except in houses built over forgotten streams and pools imperfectly drained. Until the Public Health Committee engaged itself actively, there were many stagnant and foul ditches; for instance, that in Great Clarence-street, injuring the health of those who lived near.

The streets which stand highest above water-mark indeed were notably free from cholera, or what to my

mind more fully demonstrates their salubrity—it was introduced, and did not spread; but this rather depended on the concurrent absence of water-courses. In the foregoing table it will be seen that elevation bore no very constant ratio to the number of deaths. Mere lowness of surface does not seem to predispose to cholera, for Holland has been always remarkably exempt from the disease. In that country the people are famous for cleanliness.

A sudden fall in the city by the gravitation of sewage and sub-soil water promoted the disease notably; for instance, Cook-street runs along the river Liffey, only 300 feet from it, and 24 above high water mark, while southwards the ground rises so fast that the parallel street, High-street, which is about 200 feet distant, is 36 feet higher. It is much to be regretted that the Connecting Railway, which was to have demolished Cook-street, was not carried out.

The district near Ballybough-bridge, or as it is classically called, "Mud Island," and that around St. Laurence O'Toole's Church, is reclaimed land, where drainage is necessarily imperfect, and in which the houses are so wretchedly constructed, that the mere earth, or, at most, boards laid directly on it, forms the floor. To the same character of soil the prevalence of the disease in the neighbourhood of Montgomery-street may be assigned. Hanover-street, East, around which many deaths occurred, is also built on reclaimed land, and I understand that the drainage of that district has been much obstructed since the Grand Canal Docks were constructed. Without the utmost care being taken in draining land reclaimed from the sea, and in building houses thereon, it can never be salubrious.

My friend, Dr. Druitt, gave a most able account of Amiens, where cholera raged fearfully during last May and June. It is a city built upon numberless streamlets of the Somme, the lowest parts being swamps, the

upper crowded with cesspools. So absorbent is the subsoil in the higher levels that these receptacles, it is said, do not require emptying in a century, but their contents must fall to the houses below. The houses of the poor are filthy, and their diet bread and potatoes; and they are "ill-washed, ill-aired, poor-blooded people." There is an admirable supply of pipe water, bnt it is suspected that those living on the borders of the streamlets use their waters. The haunts of cholera were the very same which are almost constantly infested by "the miliary sweat"—a disease now unknown in these countries, but which is undoubtedly a form of "the sweating sickness," which once devastated England. The cholera did not confine its attack exclusively to the lower classes, for many physicians and Sisters of Charity had fallen at their posts. In India, ill-drained spots are the habitats of the disease, and artificial cholera-fields are made by the mode of cultivating rice. I have collected also numerous facts to show that in that country the disease haunts the course of streams which flow through the towns.

Mr. Orton states that in the Limehouse district in the East of London 200 deaths by cholera occurred within 200 yards of the Regent's Canal, and another area of mischief was bounded on every side but the western by water channels. He thinks the disease did not cross the Thames, because of the tidal current and river breezes.

This sanitarian exhibits the careless way houses are located in some parts of London, and describes a group of 120 houses, the boards of the lower story of which rest on the earth. Inquiries among the inmates almost universally got the following answer: "Never been well since coming in, and the children always ailing; and my husband says he feels more refreshed when he comes from his work than after he gets up in the morning. And then everything spoils; meat put

into a cupboard is musty in a night; one can keep nothing. Clothing becomes damaged; the drugget rots in a month; boots and shoes, and even the beds we lie on, are mildewed in a week." Good fires in such cases would, I think, be highly protective.

Other houses were built on the site of a gravel-pit, the space being filled in by the scavenger with abominable filth. He properly suggests that the Building Act should render a layer of concrete under the flooring obligatory. Mr. Orton's report is notable likewise from being the only one which has opposed the theory that cholera spreads by water-supply; but his arguments and facts on this matter, and on the nearly entire exemption of water-drinkers, I think are inconclusive.

It has been remarked that in the many-storied tenement houses of Edinburgh, and London, and Paris, both typhus and cholera have been found most frequently in the top story and the basement, and one can explain this by remembering that terrestrial exhalations, distilled just below the latter, would rise towards the roof, at which there is seldom any ventilating outlet. The same thing has, I find, been true of the late epidemic in Dublin, especially with regard to the basement floors. In many respectable houses the servants were attacked, while the disease did not go upstairs.

Drainage, and the laying of impervious foundations, are expensive works; but the waste of life and health by cholera, fevers, rheumatism, and other zymotic diseases, and by general depression of healthy vigour which they will prevent, will afford ample repayment. These measures take much time, and it will never do to begin them when cholera has already arrived. A Building Act is required before such works will become general, and to prevent speculators building "fever nests," and, I may add, cholera-traps, on any site,

and in any way which may be cheapest. The foregoing reflections also show that the pollution of rivers by sewerage, like other outrages upon natural laws, cannot be committed with impunity. It has been often remarked that cholera has prevailed on one side of a river, and not the other; but the soil on one side of these natural clefts may be favourable, the other not so. I told you of a similar fact when speaking of the influence of limestone in causing goitre.

The influence of filthy nuisances in attracting cholera has been often dwelt on; but Mr. Lee of the Board of Health, in his report upon Liverpool, after the 1849 epidemic, says: "During an inspection of thirty thousand houses, I only met three instances in which the house where death from cholera occurred had not a foul open privy against its wall."

American writers record the following case, showing the efficacy of cleansing before the outbreak of cholera. In 1849 the Board of Health of Baltimore asked for five thousand dollars for the purpose of putting the city in order against an invasion of cholera, as that disease had already appeared in several neighbouring cities. There was a prevalent opinion that this city was on the eve of an outbreak of pestilence. The Mayor called a meeting of the Council, and the money was promptly furnished. Baltimore was in a very filthy condition at the time, and the health officer stated that the appropriation would have been a mere drop in the bucket for cleansing the city, but the general determination of all the people was, that if cleanliness could secure immunity from pestilence, the cleanliness should be secured. The city was almost thoroughly cleansed, the exceptions being a miserable hovel about the marshes of the Patapsco river, and one closed filthy alley. The hovel was occupied by an old German woman and her son, both of whom died with cholera. A man occupied a room opposite the City

Hall. He died with cholera, and upon examining his room, it was found that he had been sleeping with his window opening into an alley, and that there was more filth in that alley than in all the rest of Baltimore. These cases were the sum total of mortality from cholera in Baltimore in 1849.

The difficulty of explaining the ravages of cholera in a city, by a reference to the relative number of filth depots, or of the proportion of pauperism in various districts, is shown in the following table, arranged from one by Dr. Littlejohn of Edinburgh, whose recent publication is, perhaps, the most comprehensive sanitary report ever issued in these kingdoms:

Districts.	No. of persons to acre.	Proportions to each 1,000 inhabitants of			
		Untrapped Cesspools.	Paupers.	Cholera, 1849.	Fever 1847.
Grassmarket ..	237·6	2·6	58	19	239
St. Giles' ..	234·8	3·5	51	12	111
Tron ..	352·6	1·7	58	11	113
Fountain-bridge	114·8	3·3	29	·2	12
Newington ..	39·9	8·	19	·2	2
West End ..	44·2	8·9	69	·4	7

It will be seen that the density of population tallies closely with the proneness of both cholera and fever, a fact which supports the contagiousness of both diseases. Cholera and fever cases were, however, most numerous where untrapped cesspools were least so, and the proportions of these diseases to the proportion of paupers is by no means regular.

The direct proportion between elevation and freedom from cholera was also shown in these districts, and still more strikingly in each part of them; for instance, 19 per 1,000 of the cases in St. Giles' occurred between

200 and 250 feet above sea level, while only 6 were between 300 and 350 feet.

Our Poor Law Commissioners extensively published the following most encouraging fact: "During the whole of the epidemic in London in 1849, not a single case of cholera occurred in any one of the model dwellings of the poor, though the disease raged in the districts in which these dwellings are situated; and there were instances of two, and even four, deaths in single houses close to their walls."

Cholera has often suddenly broken out in ships, but never if they have been away from land for more than the incubative period of the disease. I have cited two instances of the immunity which sailors taken from healthy ships to the infected ones enjoyed. The drinking water of many vessels has been found to be abominable; that of the *Olive* last October, in this port, was shown by Prof. Cameron to contain 10 grs. of organic matter and infusorial animals visible to the naked eye. Vigilant inspection is urgently required to prevent such neglect, and was authorized by the Privy Council Order 11th Sept., which gives the local authorities the same power over a ship as if it were a house in their district. From the ill-aired and crowded state of emigrant ships the disease runs a fearful course if the germ is introduced.

There is a general impression that Indian medical writers are anti-contagionists, but some of the most reliable of them take a contrary view—for instance, Dr. Jackson, Presidency-Surgeon, Bengal, says: "In the native boats which are in the habit of carrying tooops from one station to another, when it has occurred that one regiment, taking the returning boats of another corps where the cholera had existed, has afterwards been seized with the disease, and the men have been decimated, though no case had occurred amongst them until they had made this change." He also records his

experience, that cholera usually broke out on the side of hospitals nearest to the privies.

Two things then must concur to produce cholera—namely, the germ from an infected person and the peculiar emanation from the kind of soil I have been describing—a "civic" or excremental miasm, as distinguished from the rural miasm to which ague is attributed. The place where this union takes place may be in the porous and impure soil, or it may be in the body of the patient. Pettenkofer favours, but is not positive as to the second mode. The period of the incubation of this hateful embryo may be as much as three weeks, but it may be counted by hours, and two days is a usual period.

3rd.—With regard to susceptibility or "reciptivity." It is evident to all that the humbler classes suffer most from a cholera outbreak, and it is therefore all-important to study the reasons for this proclivity, which was most marked in the late outbreak, scarcely a person in comfortable circumstances having died within the city of Dublin. Pettenkofer considers, plausibly enough, that a watery condition of the blood, with a superabundance of imperfect fibrin, is favourable for the taking on of cholera; and this condition, physiology teaches us, exists normally in the child, where tissue-change is so active, and in the aged, and can be produced artificially in ourselves, as in the lower animals, by overwork, and by the partial deprivation of the animal and other nitrogenized articles of diet which are so essential to vigour and firmness, and to resistance of all catching diseases. The same blood-condition renders the female in childbed prone to catch and to die from that fearful zymotic, puerperal fever, and other communicable diseases, because the lessening of the womb throws much effete matter into the blood. Now, experience has shown us, that cholera is most fatal to the very young, to the very old, and to the very poor, to whom

animal food is such a rare luxury. Prof. Acland, in his "Memoir on the Cholera in Oxford," has shown that many lives among the poor were saved by the issue of animal food during the epidemic of 1854. Science, therefore, as well as positive and negative experience, point to this particular constitutional proneness, and enjoin upon us charity towards the poor—and in defending them we save ourselves.

The striking immunity of the Whitechapel Jews in the last as well as all former epidemics was due to the timely distribution of animal food, and to their excellent hygienic observances, which have made the longevity of this race one-third greater than that of most European people. In India, the outbreaks so often follow a failure of the rice crop, that some have attributed the malady to some fungus from that grain. The want of free air to oxygenate the red-cells of the blood, and the neglect of cleanliness of the skin, may be other predisposing causes amongst the poor, of which I have said a good deal in previous lectures. Medical attendants and Sisters of Charity are protected by their more wholesome mode of living, but they fall victims occasionally—thus, in 1832, four out of ten nuns who attended the patients in Tuam, caught the disease, and seven of the nine medical men of Sligo died of it. In the former town, a clear case of contagion occurred. After cholera had ceased, the beddings used by the patients in the hospital were stored, and one month after the last case, the apothecary and two assistants were engaged for several hours in removing them. On the following night two of these persons were attacked with cholera, and died. Dr. Little, who attended 550 cases in that town, satisfied himself as to the contagion in every case.

Intemperance, by depressing health, and especially by checking the removal of carbonic acid and other excrete matter, and thereby vitiating the blood, is a

predisposing cause of all catching diseases; and the blood-poisoning, which students of my own profession suffer, is no exception. I have rarely known a student seriously injured by a dissecting or hospital wound, unless he had been addicted previously to late hours and occasional debauches.

Very many of the victims of cholera in Dublin were of drunken habits, and on Mondays and Tuesdays there was an increase of cases, which the intemperance of Saturday night or Sunday promoted. In London, in 1849, the deaths on Mondays and Tuesdays were about a seventh greater than on Thursdays and Fridays. The Indian cholera commissioners reported that spirit drinkers were not more liable to the disease than others, but that it was fatal when they were attacked. As I told you before, the teetotallers will have it that none but alcohol takers suffered, but the fact that 208 out of 1,104, or about a fifth of those who died in the whole of the Dublin registration district, were under five years of age, disproves this assertion. It is recorded that thirty cases occurred on New Year's morning, 1832, in Gateshead, no case having been previously seen. Nearly all the victims had been intemperate the night before. That some antecedent condition of the membrane of the alimentary canal existed in the persons of those who died by cholera, is probable, from the researches of Dr. Beale, Prof. of Physiology in King's College.

I have not been able to procure any evidence to show that persons suffering from habitual diarrhœa or constipation were inordinately prone to catch cholera; but I believe in the preventive power of a flannel belt, which keeps up the heat and circulation of the abdomen. Neither did one fact occur to me to show that fear offered any inducement to the attack. I saw very many cases in which diarrhœa and prostration were due to its influence—cases, in fact, of cholera-phobia—but none developed the unmistakeable features of the true disease.

Dr. Forbes Winslow went so far as to assign most of the deaths from this and some other diseases to fear and the other passions, and advised that efforts should be made on all sides to calm them. In most instances in Dublin rashness rather than panic prevailed, and official interference was often necessary to prevent crowded wakes. Many instances are recorded by Indian writers of the production of cholera by fear, but I cannot convince myself that in every case some more intelligible cause could have been discovered by patient search. I think a man could no more frighten himself into cholera than he could into small-pox or any other specific disease. The keeping up of games and sports has been said to be most advantageous when cholera breaks out at a military station.

The greater immunity of officers above the men in India is a well-known fact, which may be explicable by some of the circumstances I have just referred to. I have stated that water is frequently the vehicle by which the cholera-germ enters the body, and I believe that it may be also one of the agents by which a peculiar receptivity may be induced. The drinking of water loaded with organic impurity from sewage or other animal matter will certainly depress health, and probably vitiate the blood, and spoil the organs which depurate it, and thus render the body fit to receive the contagious germ. The inhabitants of Cook-street, where the most extensive outburst occurred, and those of Duke-street, which of all localities was that in which the greatest number of cases appeared on any one day, had been habitually drinking water which the analyses of Prof. Cameron proved to have been loaded with organic matter and nitrates, which are nearly always due to pollution from sewage. Both sources were immediately closed, but the cholera did not cease ; and if the view I have stated above be correct, the removal of the pump-handle bears a close resemblance to the bolting of the stable-door when the steed has vanished.

However, such a promotive of cholera is avoidable by the provision of good water to every house, so that laziness shall not cause the selection of a nearer and worse supply, and the absolute and permanent prohibition of all dangerous wells.

With regard to meteorological influence we know but little. The Rev. Prof. Haughton has announced that a variation of amount of ozone is not an efficient controlling force, for it has been discovered by a northern linen-bleacher that ozone test paper merely indicates the varying force of the wind, and is in fact the most delicate anenometer known. The same philosopher has shown that an interval of 34 years occurred both between two great outbreaks and the meteoric showers which might injuriously affect the atmosphere. Dr. Howe has endeavoured to show that the time of the periodicity of epidemics is 18⅓ years, but the epidemics of 1849 and 1854 do not tally with the former calculation, nor the last named one with the latter. It would be all-important to ascertain if such periodicity exists, as it would enable us to take all necessary precautions.

Extreme heat and extreme cold, which respectively suppress the plague and yellow fever, seem to have some preventive power over the propagation of cholera. The influence of the latter is the only one manifested in these countries. That it has lingered in Russia with the thermometer below zero is not surprising if the filthy habits of those who live in the stifling huts in that empire are remembered, and the water they use is from melted snow fouled with every impurity. The greatest cold ever noted in Dublin, namely, 2·8, occurred on one night in the week, succeeding the last case. A boy aged 13 died from exposure to cold on that night, near Swords. Rainfall has been sometimes supposed to retard the disease, at other times to spread it, and the ideas, I think, are reconcileable as follows. In a town, the houses of which are all placed high, well sewered

with an efficient outfall, a flood of rain will wash excreta safe away, whereas if some of the houses are situated low, as for instance along the edges of the river, the rainfall will carry the excreta from the higher houses to the subsoil of the lower. Those who have seen cholera in "its home" believe rain is most salutary. Dr. C. King, Poor Law Inspector, suggests that rain may wash the organic matter which a previous drought has parched towards the rivers, and thus promote the spread of fever and cholera along their beds.

Dr. Frankland states that a temperature of 55° is necessary to promote putrefaction of organic matter in water, and the resulting impurity in that fluid is best shown by the small proportion of oxygen to nitrogen in the gases which it holds dissolved.

You will remember the interest which was excited by Mr. Glaisher's statement that the outbreak of cholera in a town was usually accompanied by a blue mist around, which was remarkable for not moving with the wind. It was stated, too, that the "blueness" was owing to myriads of those spores of fungi so usual in the air in hot seasons, and which have been said to be coincident with blights of many crops. A moist air would aid the conveyance of cholera matter. In the table on page 443 I have given the chief meteorological data for several weeks before which and during which cholera was with us, and those of the corresponding weeks in the last two years.

There is comfort for some in Pettenkofer's assurance that one attack of cholera confers an almost absolute protection against a second, and great advantage may be taken of the circumstance if verified, as nurses and other attendants may be selected who are thus protected. A similar way of economising life has been adopted successfully in typhus epidemics.

I will now briefly tell you of the extent of the last and the former epidemics in this country and in England.

During the cholera epidemic of 1849 in England, this foreign enemy slew 53,293 persons, while by diarrhœa 18,887 succumbed, and in Ireland 45,698 cases, and 11,129 in one month alone, were treated by physicians appointed under the Board of Health, and with the fearful mortality of over 42 per cent. The numbers which occurred in various towns seem most anomalous, and were then quite incapable of explanation. I have entered upon the inquiry, "Does the water-supply and drainage of each town explain these variations?" and trust to be shortly able to announce results of some importance. I will cite now but one remarkable instance. The town of Kells contained 4,205 inhabitants, out of whom 330 were attacked during the seven weeks ending 16th August, 1849. The neighbouring town, Navan, situated on hills, and well watered and drained, containing nearly one-third more inhabitants, had but 38 cases during the whole visitation. Kells, even in the very way its street are planned, presents examples of the most insalubrious conditions. Two of the streets run parallel with the backs of the houses, so close that no room whatever is left for yards or other conveniencies, and these were the very places where cholera raged most intensely. A most able resident physician informs me that "the town was densely crowded with people living in wretched cabins, huddled together without much regard to cleanliness or drainage. Our supply of water was from shallow wells and a few pumps, not at all sufficient for the wants of the town, and there is a small dirty river with a reservoir."

During the week ending 28th July, when the first case occurred with us, the cholera destroyed 87 in Liverpool and in London burst out fiercely, 1,253 deaths being registered to its account and that of diarrhœa. In the words of the Registrar-General's Report:

"The mortality is overwhelming in some of the districts. In Poplar alone 145, in Bow 188 people died last week, including

Dr. Ansell, the meritorious health officer, and Mr. Ceeley, clerk of the Board of Works, whose name figures on the placards. The people are falling ill every hour; you see them of all ages, children and adults, lying about their beds like people under the influence of a deadly poison, some acutely suffering, nearly all conscious of their fate and of all that is going on around them. Here the doctor is drawn in by the husband to see the wife now attacked; there the husband lies in spasms; here is an old woman seated dead, with eyes wide open; there lies a fine four-year old child, his curly head drooping in death, but his mother says the pulse is strong, and he takes what she gives him. An older brother just recovered is running about. Several wards of the London hospitals are full of patients, many of them very young children in all stages of the disease—some dying, some well again and playing. The medical men have no rest, and with the health officers are nobly doing their duty—brave men ready to lay down their lives for their patients. The people themselves are most patient—most willing to help each other, the women always in front, and none shrinking danger. There is no desertion of children, husbands, wives, fathers, or mothers from fear. In the midst of this scene the authorities have been to some extent paralysed. The nuisance inspectors are not sufficiently numerous, neither are the medical officers. The administrative work has not been organized with sufficient promptitude, and it is not carried out with sufficient energy."

On the 3rd of December he reports:

"The total number of deaths from cholera in the present epidemic have been 5,548, exclusive of 2,692 deaths from diarrhœa, due in part to the cholera element. In the year 1849, when the population was about two millions and a-quarter, cholera slew 14,137 people of all ages; in 1854 not less than 10,788 out of two millions and a-half; and in the present year, when the population exceeds three millions, the deaths have been 5,548, of which 3,909 occurred in the East London districts, and 1,639 in the rest of the metropolis. The deaths to every 10,000 of population were 62, 43, and 18 in the three epidemics all over London. In the present epidemic the West Districts lost 4, the North Districts 6, the South Districts, 9; and it was only in the East Districts where the ravages recalled the violence of former epidemics, that 3,909 people, that is 64 in every 10,000 of the unhappy inhabitants, perished. Holland and Belgium have published returns down to a recent date, for which the Registrar-General is indebted to M. de Baumhauer and M. Heuschling, and the facts prove that the epidemic as fatal as it ever was under unfavourable sanitary conditions.

Thus in 22 cities and towns of Belgium and Holland, containing less than half the population of London, or 1,460,808 people, the deaths from cholera alone in the present year were 20,643. So the deaths were 141 in 10,000, and if the same proportion of inhabitants had perished in London the deaths instead of five would have exceeded forty-two thousand. In Brussels the deaths were in the proportion of 164, Utrecht 271, Amsterdam 42 in 10,000 inhabitants."

Direful as outbreaks of cholera are, they are not without their advantages, for many great sanitary inquiries and improvements have dated from them.

In some places, however, local boards are too callous to be taught by such experience. A district of Bristol, measuring but 1850 square yards, was so badly drained that the stench from the gully grates was most horrible. In this confined space, containing 61 small houses, there were 89 cases of cholera and 36 deaths; and yet, says Dr. Sutherland of the Board of Health, "notwithstanding the terrible warning given in this case, and the temporary measures adopted at the time, I learn from Mr. Clark's report on Bristol, that within twelve months after the catastrophe everything has reverted to its old condition; and were cholera to recur, it would find its former haunts ready to receive it."

The example of Carlow is instructive; it was devastated by cholera in 1849, while the town of Graigue, only divided by the Barrow, a wide river, was lightly touched. Carlow has been sewered under the Improvement Act 1854, and escaped last year altogether although Graigue suffered most severely. A loose moist soil, with cesspools, favoured the frightful attack of cholera in Southampton in 1849; drains and waterclosets, and a copious supply of good water have now limited it very strikingly, according to Dr. Parkes' most admirable report. The cholera field in the east of London was the very place where the main drainage works were not completed. The history of the cholera in 1854 in Ireland is most striking, different from that of all other

epidemics—for instance, the Commissioners report that 40,000 cases, including choleraic diarrhœa, occurred, yet the per centage of deaths was only 8·7, while it approached 50 per cent. in previous outbreaks and the one just passed.

In the late epidemic there was a larger proportion of cases without the warning diarrhœa than in the former ones, and very many who were in apparently rude health were struck down. The same causes which produce severe cholera in a predisposed person will give rise to diarrhœa, or as the French call it, cholerine. It is right, of course, to treat this disease at once, but we should not be too boastful of having cured it, for the case might not, if left alone, assume features of the graver malady.

As to the intimate effects of the cholera poison on the human body, we have no positive knowledge. The more I allow myself to theorise on the subject, the more I feel convinced that it acts by exciting the sympathetic nervous system—the capillaries becoming therefore contracted, the secretions checked, the animal temperature lowered, and the body cramped and shrunken. The loss of fluid will not account for the sudden shrivelling of the tissues which occurs in many cases. Some remarks on this theory I published in the *Medical Press*, 12th September, 1866. The only fact which I have observed against this idea is, that children, in whom the sympathetic system is most active, present collapse in the least degree; in fact, I have seen them die without its being fairly developed. Other blood-poisons act also on the heat-making function of the body, as even the precursory shiverings indicate. The cold breath indicates the want of oxidation and retention of carbonic acid in the blood.

Four cases of what was best named "black typhus" occurred on respectively March 19th, May 12th, 13th, and 17th. In the minds of many thoughtful physicians this seemed to portend dangers looming in the distance, of contagion arrived, and with many countries with which

we are commercially connected we have likewise a free trade in disease. Early in August, while the cholera epidemic was virulent in Cook-street, one of the cases attended by my friend Dr. Ryan put on many of the features of the black typhus, and on the 16th of January, I was asked to investigate in Kingstown a case which destroyed in 26 hours, with symptoms identical with those previous to the cholera outbreak. I trust it may not be followed by a similar calamity this year.

I have not ventured to speak of the curative treatment of cholera, but it was often my duty to warn the poor against quacks, and ignorant and most pernicious amateurs. The vaunted cures of one of these were so fully exposed in a letter to a daily paper by a late pupil of mine, that I will quote it entire:

"Sir—During the past week two communications from Major Bolton have appeared in your columns, both in reference to the treatment of cholera by means of the saturated solution of camphor. As the medical profession is in a manner put on its defence by the tone in which these letters are written, I hope you will be good enough to give me space for a few remarks—and first, of Major Bolton's own method of treating cholera. Up to Saturday last he always directed that the tincture of camphor should be administered in a teaspoonful of cold water. Now, if the tincture be dropped into water the camphor is set free, and floats about in lumps on the surface, rendering the mixture little more than ordinary camphor julep. Dr. Rubini, being of course aware of this fact, has all along treated his cases with the pure tincture, and has repeatedly stated that if water be used as a vehicle, the curative properties of the camphor will cease. Major Bolton seems only to have discovered this on Friday, and hastens to inform the public that 'he no longer recommends' a proceeding which he has been persistently recommending for the last three months! If the addition of water destroy the 'curative properties' of camphor, it is only natural to ask what becomes of Major Bolton's 'cures,' of which we have heard so much since the appearance of the epidemic?

"The experience of all legitimate medical men pronounces camphor a failure in the treatment of cholera. The experience of Rubini and other homœopathists pronounces it an absolute specific. How are we to reconcile this rather obvious discrepancy?

A little pamphlet has lately fallen into my hands which I think clears up the matter very completely. It is entitled '*Preservativi del Cholera*,' and is published at Genoa by two homœopathic physicians, Dottori B. Brune e P. Gatti. These gentlemen describe the first stage of cholera thus: 'Lassitude, giddiness, anxious countenance, chilliness, singing in the ears, warmth in the stomach, slight cramps in the legs; *Poca sete—mancanzi di vomito e diarrea*—little thirst, absence of vomiting and diarrhœa!' This being, according to the general Genoese doctors, a bad case of cholera, they wrap the patient up in blankets, and give him three drops of camphorated spirits every five minutes. In less than an hour healthy reaction sets in, and we have another case of cholera cured with camphor. An allopathist diagnosis would certainly be different, but his treatment would probably be very similar. I now come to the most important point. Hear *I dottori* Brune e Gatti further: 'Lax canfora e il sovrano, no specifico di questo periodo; *in tutt' altra circonstanza e damrosa. Essa non preserva punto*—camphor is the sovereign specific in this stage; *under all other circumstances it is most prejudicial. It is not of the smallest use.*' It was certainly under 'other circumstances' that I tried it, and found it, as they say, 'useless.'

"The doctors then describe the 'secondo periodo' of cholera, which is exactly the same as the first stage of every body else, and is marked by 'vomito, crampi, diarrea,' &c. They here denounce the employment of camphor, and recommend globules of *veratrum album*, and the application of a penny (moneta da 5 centesimi), 'sulla regione del stomaco,' because workers in copper are singularly exempt from cholera! The pamphlet, I may add, issues from the Instituto Omiopatico di Genova, Strada Canneto, lungo, N. 800.

"I would now ask, may not the failure of the camphor in the hands of so many medical men be attributed to the fact that they do not recognize the 'primo periodo' of Doctors Brune and Gatti. With camphor homœopathists treat a disease which *they* choose to call cholera, but which *we* know to be a mere form of nervousness common in cholera seasons; while in the disease CHOLERA, as that word is understood by the public, the press, and the profession, *we* find camphor useless,' *they* find it most 'prejudicial.' As a homœopathist, Major Bolton should reconsider the matter, and ponder on the consequences of advising a fellow-creature to dose himself with the 'specific' in the 'secondo periodo,' when he should rather put his trust in the *veratrum album* and a penny to the pit of the stomach.—Yours obediently,

"MAXWELL REILLY, M.R.C.S.

Assistant Medical Officer, Swords Cholera District."

I may mention incidentally that there never was a time when quackery was dealing more fatal blows at the health of the credulous and morals of the young. The Medical Act, in this respect at least, has been an utter failure, and the legislature is bound to provide some other protection—the diffusion of a knowledge of the laws of health being in my opinion the most reliable. It is, by the way, very disinterested in our profession to rail at quackery, for to it we owe very many of our "cases."

The result of treatment has been very perplexing and saddening; yet there is no reason to think that the French mayor was right when the only preparation he made for cholera was to dig some scores of graves. The co-efficient of mortality in Sir P. Dun's hospital has been 47·22 per cent., and that of other hospitals and out cases has been very similar.

Isolation of the patient attacked is so essential for the safety of his fellow-lodgers and for the community, that I would not hesitate to remove a patient to hospital in any stage of cholera. With care, I know of no injury which the patient can receive, especially as it must be confessed that the disease is as yet nearly beyond our curative skill. It has been well said that as prevention is our object, we should act as in the case of a rapid conflagration—namely, save the surrounding buildings, not waste our efforts on the doomed one. My opinion entirely coincides with that of Dr. Buchanan, officer of St. Giles', who reports that out of twenty instances where the first case was removed to hospital and disinfection performed, a second case only occurred in one house. Whereas in fourteen instances the first patient was not removed, and in seven of these houses second or third cases occurred. Isolation, therefore, seems to me advisable, if the saving of human life be our first consideration.

In Germany the establishment of "houses of obser-

vation," to which persons affected with premonitory diarrhœa are removed, has been found most useful—only four per cent. of those treated thus early developed true cholera.

As you will recollect, provision was made for the relief of those attacked, by keeping a medical officer on duty at each of the seven dispensary stations night and day. No orders were necessary, and urgent cases were immediately attended at their homes. Had the epidemic become more extensive, I presume that a room-to-room visitation by senior students would have been organized, the more especially as towards the end of the visitation great reluctance was shown to enter hospitals, the plea of high mortality being alleged, and many cases were only announced by some frightened neighbour. The hospitals were Sir P. Dun's, Meath, Mater Misericordiæ, and, for a short time, a temporary hospital in Green-street. Sheds at Kilmainham were erected, but not used; but if the epidemic was extensive they would have relieved the hospitals, for it is far better to let patients sleep even in a tent than to crowd them into a scanty space. During the war in the East, the hospitals of Varna were crowded with cholera patients, and the mortality was frightful; the famous hygienist, Inspector Michael Lévy, erected hospitals under canvas, and prevented crowding, with the happiest results. Dissatisfaction arose with regard to the conveyance of patients to hospital; the spring-carts were kept at the north and south workhouses, and valuable time was lost, and confusion created, by not having a sufficient number of vehicles at each of the hospitals. A cot, comfortably fitted inside with cushions and warming-jars, and permitting the patient to lie recumbent, and carried with long poles, would be a very convenient ambulance, and one might be placed at every police station, constables being specially told-off if the duty of carrying the patients would not be generally accepted. For the relief of those

left destitute, over £4,000 was quickly subscribed, for the need was pressing and many of the victims were in rooms without furniture or bedding, or even a cup to give medicine. It seems to me madness to insist on home attendance under such circumstances. The zeal of the dispensary physicians was unsurpassed.

The greatest benefit accrued from the houses of refuge which were established at 9 Nicholas-street and at the former prison, Green-street. While their rooms were being disinfected, the relatives of any person seized with cholera were cared in these establishments. 85 persons were admitted into Nicholas-street, and only one case of cholera arose in it; and 250 into Green-street. Such refuges were established in Liverpool both in 1849 and last year. Dr. Gee, who was appointed under the Privy Council order, informs me that the relatives were first examined in a part of the workhouse, and after their clothes had been disinfected they were passed to the refuge; out of many hundred admissions but three cases arose in it. He very justly dwells on the benefit in the way of checking typhus and other catching diseases if such a "sanatorium" were established permanently. This is a better designation than "house of refuge" which often implies a different class of institution.

During an extensive epidemic in a large city very numerous hospitals and refuges would be desirable, so as to render it unnecessary to carry the patient a distance, and they should be secured as soon as there is reason to think cholera is approaching, and we have usually some months' notice. If the authorities wait till the contagion has arrived they will be obstructed by individual selfishness, and the clamour of the prejudiced and terrified. I cannot forbear from recording my humble testimony to the watchful supervision which was exercised over all means for checking the disease by the Right Honorable the Chief Secretary and the other Poor Law Commissioners.

LECTURE XIX.

THE CATTLE PLAGUE IN ENGLAND AND IRELAND.

I MAKE no apology for detaining you for a short time on the subject of the cattle plague, that most contagious of all maladies with which the animal world is afflicted. This malady is so interesting in its pathological features, and so fraught with danger to national prosperity, as to have attracted to its study some of the ablest physicians in London, not exclusive of the illustrious Sir Thomas Watson, and in Edinburgh such men as Sir J. Simpson and Dr. Playfair. Most of the facts relative to the disease were moreover made out by members of our profession. This country, above all, would have suffered severely if the contagion had been carried freely into it. Providentially, we were, however, exempted from any extensive outbreak, which should have ended in agricultural ruin. Another reason why the subject concerns public health may be gleaned from the writings of that eminent statist, Sir William Wilde, and also those of Dr. T. M. Madden, who has written an essay to prove the close connexion between epizootic and epidemic diseases, and if this were acted on, the cholera would not have found us unprepared. He has also elucidated many interesting facts about murrains which raged in Ireland in previous centuries. Dr. Madden thinks the connexion proves the epidemic constitution of the atmosphere. Dr. Farr raised a very interesting question with regard to the curves by which the epidemic rose, and by which its decline might be anticipated, and he contended that "stamping out" had very little to do with its disappearance. As an example of the adage that there is "little new under the sun," I have to acknowledge that the account of the symptoms and prevention of the

cattle plague given by Lancisi in 1720 has been scarcely surpassed.

The importance of the subject of the cattle plague will be felt from the following statistics: It has attacked in Great Britain 253,807 head of cattle, and 52,528 healthy beasts were sacrificed to prevent its spread. It has lasted eighty-two weeks, the greatest number of attacks having been in that ending 17th February, 1865, namely, 15,706. In the following week "The Cattle Diseases Prevention Act," which legalized more fully the stamping out process, became law, and the week ending 3rd March the number attacked was but 9,814. Low temperature seems to be the only meteorological condition which we know promotes the disease; but, indeed, this may be only coincident with the housing of the animals, which would of course spread it. Terrestrial conditions seem to have no influence, as it is spread solely by contagion. Some assert that it is most virulent in low-lying marshy places. Last January, Dr. Foot, Dr. Hayes, and I (among others), having been honoured by instructions from the Lord Lieutenant to make ourselves acquainted with the symptoms and modes of prevention of the cattle plague, proceeded to London and various rural districts in England. With the aid of Mr. Helps, of the Privy Council Office, and Professors Simonds, Spooner, and Browne, we were afforded every facility for studying the disease. I shall first describe the diseased conditions which we found on dissecting the cows which had been affected with the plague. The eyes appeared sunken in the head, from the swollen condition of the lids; the surface membranes of the eyes were injected with blood, and from their corners the remains of the characteristic muco-purulent discharge could be seen staining the hair of the cheek, and matting the eyelids together; the surface membranes of the lips and gums exhibited shallow abrasions of various extent and irregular shape, not unlike "mouse-eaten" spots; similar

appearances were visible, but to a less degree, upon the palate; the conical elevations at the angles of the mouth, naturally white, were pinkish, enlarged, and in some places looked like pointed pustules; other mucous surfaces were congested, and issued a reddish discharge.

About the bases of the teats there was a scabby eruption, in the form of flattened, dirty yellow crusts, upon the removal of which the underlying skin exhibited a reddened stain, but there was no evidence of any loss of substance or depression in it; the eruption was not confined to the udder, but was observable along the abdomen and in other places. The presence of air under the skin was detected by the pressure of the hand along the inside of the thighs and about the udder, where it crackled. The cellular tissue between the hide and flesh was very much congested, and its red colour, contrasted strongly with the whiteness of this structure in health. In many parts it was greenish, incipient putrefaction having already set in, although the temperature was low, and snow lay on the carcase. The odor from the body was peculiar. The first stomach was filled with undigested food, the result of interrupted rumination. The interior of the third stomach was of a uniform purplish colour, and the plaits were streaked with darker lines, corresponding to the course of the blood-vessels. The gall-bladder was distended with thin, orange-coloured bile, and likewise contained air, probably of a septic origin. Parts of the small intestines presented congestions of the mucous surface in various degrees, but no indications of disease of the cell-glands were discovered. In the beginning of the large intestine were enlarged solitary glands, forming small, soft nodules, the size of duck-shot. The mucous lining of this bowel was most abnormally vascular; the congestion assumed the form of patches, stellate markings, and streaks, which gave in some places the appearance of the zebra's marks. The interior of the windpipe and larynx was intensely congested, of a deep

red or plum colour. A red, gluey muco-purulent secretion adhered to their lining membranes; when removed with the finger it was ascertained not to be of a diphtheritic nature, and under the microscope contained no lymph. The margins of the lungs, the spaces between their lobules and those in the chest, were filled with air. Beneath the lining membrane of the cavities of the heart there were blood spots very characteristic of this disease.

We examined the body of a sheep which had been infected with the plague, by having been placed in a stable in which a cow had died of it on the 30th of December. The sheep first took ill on the 8th of January, and died on the 13th. The only diseased appearance on its body was intense plum-coloured redness of the fourth stomach, especially in the neighbourhood of the intestinal orifice. Another form of disease had attacked its lungs, which contained many nests of thread-like animals, named filaria, which had caused the pouring out of a quantity of blood round each. The windpipe was more vascular than it should normally be, but by no means to the same degree as was seen in the cow; the secretion upon its surface was also similar, but proportionally less. The disease may affect any of the ruminants, but I believe the horse, like all carnivorous animals, are insusceptible. The appearances to be found on the bodies of the affected animals are delineated with perfect truthfulness in the famous report (3rd) of the Commissioners.

I may best inform you of the symptoms of the disease by detailing one of the cases we studied. A cow which had given fourteen quarts of milk on a Wednesday, got slack in her milk, and went off her food the next day; and on the fourth day gave half-a-pint of milk, purulent and unfit for use. She was lying down, and so weak that she could only be made to get up with great difficulty, and staggered about when on her legs, finally falling down in an attempt to turn round. The ears were lapped, the surface of the body cold; there was muco-purulent

discharge from the eyes and nose, and profuse flow of ropy, tenacious saliva from the mouth; the mucous orifices were congested; the usually characteristic abrasions upon the inside of the lips and gums were not observable in this case, and the excrement was natural. We saw that an individual case seldom presents all the symptoms of the disease; some symptoms predominate in one case, others in another, and an animal may die without having exhibited some of the most usual signs of the disease. The eruption was most plentiful in animals which had been inoculated with the plague matter.

We saw this animal again on the 18th; it was then in the 8th day of its illness, and was decidedly worse. The breathing peculiar to the complaint—such as the quadrupling of its frequency, and the occurrence of a very characteristic grunt or groan at the end of each expiration—were well established; this noise, when a number are suffering together, is most sad to hear. The beast was cold, unable to rise from weakness, and all the symptoms observed at our former visit were aggravated; indeed the creature was dying. An increase of temperature from 102° to 104°, tested by placing a registering thermometer in one of the mucous passages, is believed to be a sure and early sign of rinderpest. A peculiar and frequent shaking of the head is also often to be observed. The temperature and circulation rapidly fail towards the end of the disease.

We had an opportunity of seeing carried out the process of disinfection directed by the Privy Council to be employed prior to the removal of a dead animal, namely, scrubbing all the surface with a mixture of four pounds of chloride of lime, and four gallons of water, and plugging all the apertures to prevent any discharge escaping along the road.

We next saw two cows which had recovered from the disease, being the only survivors out of eight attacked;

these two had been ill at the same time, about three months previously; one of them had suffered from universal effusion of air under the skin (usually a very fatal symptom) to an extreme degree; the hide had been punctured, and as much as possible of the air patted out; both of them had preserved their appetite during illness, but their milk had completely failed; they had had muco-purulent discharge from the eyes and nose, congestion of the mucous orifices, and the peculiar abrasions of the mouth. In Cheshire I remarked that this pouring out of air was very frequent and early, and it occurred to me that it must have been caused by the violent breathing efforts bursting some of the air-cells of the lungs—hence the air could readily pass all over the body.

In their earliest report the Royal Commissioners remarked:

"It is still possible, by the adoption of suitable precautions, to avert the calamity from Ireland altogether. The importation of cattle into that country has already been prohibited for some weeks past. Considering, however, the destructive character of the disease, it will not be judicious to rely upon that precaution alone for escaping it. The evidence which has been laid before us leaves little doubt that it can be conveyed by persons who have been in contact with infected animals, as well as by the animals themselves. In case it should, by any accident, be carried over, the Government should be in readiness to eradicate it from any spot in which it may appear; and unless preparations are made for doing so before the plague shows itself, the authorities will hardly be in a condition to act with the necessary speed and vigour when the emergency arises. In Prussia, upon whose eastern frontier the disease frequently appears, a system of precautions has been adopted for stopping its further progress, which have hitherto met with invariable success. It would probably not be difficult to make provision for the application of similar measures to Ireland, and so to secure to it a permanent immunity from the calamity under which Great Britain is at present suffering. But the extreme rapidity with which the disease spreads makes it important that all arrangements for stamping it out, in case of its possible appearance, should be made without delay."

The then Lord Lieutenant, the Earl of Kimberley, at once appointed a committee, and in other ways displayed the greatest energy in saving this country from the calamity. The report of this committee, of which Lord Naas was chairman, contained some most admirable recommendations, a few of which I shall quote for you:

"That no person be permitted to quit Ireland in charge of cattle or sheep without a passport or return-ticket, to be obtained from the police authorities at the port of embarkation. That such passport or return-ticket shall be given for a limited period, within which the person who receives it shall be required, under a penalty, to present himself, on his return, at the office where he received his passport or ticket. That upon receiving such passport or return-ticket he shall be provided with clothes on payment of a deposit of £5, with which he may proceed to Great Britain, and upon his return he shall receive in exchange his own clothes, and deliver up the clothes provided by the police. That on his return, when he claims his own clothes, he is to receive his deposit of £5 on returning the suit lent him. That in the event of the disease breaking out in any district in Ireland, that district should be effectually isolated, and all circulation of cattle or sheep within it, or along the roads bounding it, be prohibited."

In order that this system of isolation of the early cases of the cattle plague should be fully and strictly enforced, the committee suggested an admirable scheme for utilizing the constabulary and metropolitan police in giving notice of cases, marking out and guarding the infected districts, and enforcing the isolation, slaughter, and burial of the infected animals. Prof. Ferguson dissented from the other members of this committee, and published a report, which gave most explicit directions as to the steps advisable for opposing the spread of the contagion. When the disease broke out in England, the Public Health branch of the Privy Council Department, of which Mr. Helps was secretary and Mr. Simon, medical officer, being already full of work, a veterinary sub-department was established with Prof. Simonds at its head. In Ireland the exigencies of the epidemic necessitated the formation of a veterinary branch, although no Public Health De-

partment of the Privy Council had been organized. To the energy of Prof. Ferguson, to whom the direction of this department was entrusted, our immunity must in great measure be attributed.

The history of this calamitous disease in Ireland is so remarkable, that I shall briefly detail it to you. Remembering that the cattle of the country, which were probably worth some £30,000,000, form almost its entire wealth, the exclusion of the disease was all-important. Towards the end of May it was reported to the Castle authorities that a disease which had been smouldering for some weeks at Drennan, near Lisburn, was rinderpest, and such it was at once pronounced to be by the head of the veterinary department and an English cattle plague inspector of much experience. Doubt was cast on this opinion, mainly because *post-mortem* examinations had been considered unnecessary, and dangerous with regard to infection; but all approved of the vigorous measures which were taken towards stamping out the disease. It had been introduced by drovers and dealers returning from Scotland. Early in June another outbreak was reported at Drumra, just outside the cordon which had been drawn round Drennan. The Government having requested me to witness *post-mortem* examinations of the animals affected, I did so, and detailed the symptoms which one surviving beast presented, and the appearance of its carcase and organs when slaughtered, as well as those of three other cows which had succumbed to the disease. Every symptom and appearance which are recorded in the commissioners' reports and other authorities, were noted as being present; indeed the diseased characters were more numerous than I had remarked in any one case in England, as the animals had been allowed to linger longer. Pleuro-pneumonia, milk-fever, and foot and mouth disease were out of the question, not one character of any them being observable. This decision was verified by some seven or eight veterinary

surgeons, who had studied cattle plague in England, and who were present at the dissections, and by many others who examined the diseased specimens when sent to Dublin. It was impugned, however, in a newspaper in which pathological matters were talked of so glibly as to warrant the vulgar belief in editorial omniscience.

The effusions in this journal, and the clamour of a number of persons interested in the cattle trade, induced the Government to bring over one of the officers of the cattle-plague department of the English Privy Council. Mr. George Browne, who is so well known for his manual of "Microscopical Anatomy," in conjunction with Dr. Harley, was selected. He had taught the diseases of cattle for many years at Cirencester Agricultural College, and had acted as chief inspector in London and other parts of England since the outbreak of the disease. Arrived at the infected district, he very deliberately observed the cases, not volunteering his opinions to the reporters of the provincial papers—and hence much wrath; but in due time reported to the Lord Lieutenant that they were unmistakeable cases of rinderpest. Together with Prof. Ferguson he, a few days after, announced the same sad news from Enfield, county Meath—the county above all in which an outbreak would be most destructive. After the animals had been dissected and buried, an expedition of the sceptics arrived at Enfield, and from the hearsay of the herds and such persons ventured to assert that the cases were "typhoid pneumonia." A well-known veterinarian joined in this unprofessional and injudicious course. This resolute determination not to believe that rinderpest had appeared in Ireland, in spite of any evidence, was likely to do much injury by inducing humble farmers to treat their stock without giving notice to the Government officials.

But a better spirit soon awakened. One respected member of the committee withdrew his name to mark his disapproval of the sceptics' conduct, then several fol-

lowed his example, and others proposed a vote of confidence in the head of the veterinary department, Prof. Ferguson, to whom this country owes much for his promptitude. Two facts alone could at first have given any colour to the disbelief of the appearance of the disease in Ireland. First, in the Enfield case, it could not be ascertained with certainty how the disease was imported; but the same had to be confessed in hundreds of outbreaks elsewhere, and is equally true of human diseases which are palpably catching; and, second, it did not spread extensively. This may be attributed to the isolated condition of the small herds attacked, to the summer temperature, which greatly lowers the danger of contagion, and, above all, to the prompt and vigorous measures which were adopted by the executive. Dr. Lankester remarked:

"The disease has been vigorously attacked in Ireland, and by the destruction of infected animals and the adoption of vigorous quarantine, is likely to be arrested. The stupid theory has been again revived, that perhaps the cattle plague has been originated *de novo* in Ireland. The poison of cattle plague is as distinct an entity as an oak tree or a man, and can no more be spontaneously originated than the highest organisms."

The cattle plague has been of great use to human medicine in having first demonstrated that the serum of blood contains the matter which communicates disease; and as a few grains of that from an infected beast renders the many pounds of blood in another capable of propagating the disease, we have thus the first demonstration of the fermentative increase of the blood-poisons usually called zymotic—and cattle-plague is the only *proved* zymotic. The microscope, however, fails in detecting the exact poison, for Dr. Beale, the eminent physiologist of King's College, has, with magnifying power which would make a child three feet high look as large as Mont Blanc, failed to discover anything peculiar. He believes, however, that it is in the digestive canal the chief detachment of contagious matter takes place.

The very able and plausible way in which Dr. Murchison strove to establish the identity of cattle plague and small-pox will be remembered by all of you; but the latest conclusion of that eminent pathologist was, "that notwithstanding the close analogies between the cattle plague and human small-pox, the former disease, like the so-called small-pox of sheep, is uninfluenced by ordinary vaccinia (cow-pock), and like it, therefore, is, in all probability, a distinct species of disease from human small-pox."

Dr. Bristowe, health officer of Camberwell, and lecturer on physiology at St. Thomas's Hospital, who was engaged to report on the morbid anatomy of the cattle plague, observed the resemblance between the appearances produced on the internal organs of man and of the ox respectively by small-pox and cattle plague, and they certainly agree in being the most easily transmissible of all diseases. The meat of animals which had been slaughtered while suffering from cattle plague, and even those which died of the disease, and milk from cows recovering from it, have been consumed by man without, apparently, bad effects. The meat contained little oval bodies, which were, however, discovered many years ago in sound meat by Rainey. We are not aware that they are parasitic plants or animals, or that they are injurious to man partaking of the flesh. The commissioners, however, had evidence enough to recommend "an inquiry, instituted without delay, to determine whether slaughter-houses might not be transferred from all our large towns to suburban points on the lines of railway. A few large slaughter-houses, properly arranged on the best principles, and provided with pastures and sheds where the cattle could rest, would take the place of the innumerable ill-kept and ill-tended places which exist in all large towns. The change would eventually benefit alike the customer and the butcher, while saving of pain and torture to the animals themselves would be immeasurable."

I will next mention a few of the preventive steps which were anxiously tried in England:

1. *Inoculation with Cattle Plague matter.*—I saw enough of this proceeding to convince me that it does not mitigate the severity or lessen the mortality from the disease, and is unadvisable because of its multiplying contagion.

2. *Vaccination.*—(*a*) With humanized lymph, or with lymph derived from a cow which has been vaccinated with humanized lymph. I have seen on Mr. Tollemache's estate many cows with well-formed vaccine vesicles, produced in this way, attacked with the plague, the severity or mortality of which was by no means diminished. (*b*) Natural cow-pock. As many cows which had previously had natural cow-pock have hitherto escaped the plague, although closely surrounded by its contagion, it seemed to me very desirable that a few cows which have had natural cow-pock should be exposed to the contagion of the plague, in order to ascertain if that disease protects from cattle plague or mitigates its severity. (*c*) With the matter of human small-pox. In this way the cow may be readily made to take cow-pock. I may mention that I saw in the Royal Veterinary College a sheep which, having recovered from the cattle plague, was inoculated by Prof. Spooner with human small-pox matter, and yet two well-marked small-pox pustules were produced. (*d*) With the eruptive matter of the "grease" in the horse. In this way cow-pock in the bovine species may be produced readily.

3. *Feeding with Fluid Food.*—In every *post mortem* examination which I made, the first stomach was distended to the utmost with dry undigested food, rumination being always suddenly stopped. This circumstance points to the advisability of feeding on fluid food previous to the accession of the disease.

The Cattle Plague Commissioners praise most highly carbolic acid as a disinfectant, from its power of arrest-

ing fermentative changes, and destroying the lower forms of life; the combination in M'Dougal's powder of sulphites may be useful by the giving off of sulphurous acid. These matters we will consider at our next meeting.

However, the only reliable step is that of stamping out the disease by isolation, slaughter of those attacked, and disinfection of everything about them. Owing to the vigorous way in which this was done the disease lasted scarcely more than a year, whereas it lasted 12 in the outbreak during the middle of the last century.

In a commercial point of view treatment of the cattle would be most unremunerative, as even excluding the cost of attendance, the value of the food which would be required to make up the lost flesh would exceed the value of the creature.

I think the greatness of the interests involved, and the undoubted want of educated veterinarians throughout the rural parts of this country, will lead to the establishment of a well-organised veterinary college in this city. It should, in my opinion, differ somewhat from those established in London and Edinburgh—namely, by the addition of means for the scientific study of agriculture, including investigations into the nature of the blights which attack our crops. A very large sum of money was bequeathed some years ago by an Irishman to the London University for the purpose of establishing a veterinary infirmary. Under certain conditions the sum was to have reverted to this city for a similar purpose, and I heartily trust they may be fulfilled. You may not be aware that in some continental countries the human physicians are obliged to study the disease incidental to the lower animals, and to treat them if they afterwards practise in rural districts.

LECTURE XX.

DISINFECTIONS.

All remedies against the spread of communicable diseases may be classed as those which destroy the poison, or disinfectants, and those which remove the predisposition of one person above another towards their reception. The latter subject has been discussed in almost every previous lecture. Disputes still go on as to whether certain diseases are contagious or not; but it is evident that less danger will accrue by error on the side of their contagiousness.

These substances may be arranged, according to their actions, in four classes—1. Antiseptics, preventing decay, as common salt. Such agents as carbolic acid and heat, which destroy the lower forms of animal and vegetal life, may deserve a separate class. 2. Perfumes, which disguise smell, as camphor. 3. Deodorizers, which remove or absorb smells, as charcoal. And 4. Disinfectants, which destroy gases, as chlorine.

However, for our purposes it will be far more useful to discuss these agents according as they are most suitable for destroying the seeds of disease in various situations. And 1st. In rooms. The fumigation of rooms became a trade, to which Shakespeare alludes when he makes one of his characters say, "I was entertained for a perfumer when I was smoking a musty room;" and it is said of Wolsey that "he came out of his chamber holding in his hand an orange, the meat or substance whereof being taken out, and the interior filled with a sponge, dipped in fragrant vinegar and confections against the pestilential air, the which he commonly held to his nose when he came to the presses, or when he was pestered with a crowd of suitors."

I have spoken fully in my lecture on air of the disinfectant powers of the oxygen and ozone it contains, and I believe that if a room be kept empty, with wind blowing through it for a sufficient length of time, no poisonous germ can lurk behind, as it oxidizes every form of refuse matter.

Although, however, I estimate at the highest Nature's disinfectant, pure air, I think it foolish to decry all others. The distinction between deodorants and disinfectants should be clearly understood, for I feel sure the former are always hurtful. The burning of spices and perfumes to remove the effects of foul air, as practised by the Greeks of old, and by many to this day, seems to me as senseless an act as for the ostrich to think all danger avoided when he puts it out of sight by burying his head in the sand. The enemy is only made more insidious, and thereby more hurtful. I must warn you, then, against the error of regarding perfumes, or deodorants which disguise smells, as in any way antidotal to noxious vapours. Let me read for you Prof. Johnston's opinion of scents:

"They are the only resource of rude and dirty times against offensive emanations from decaying animal and vegetal substances, from undrained and untidy dwellings, from unclean clothes, from ill-washed skins, and from ill-used stomachs. The scented handkerchief, in these circumstances, takes the place of the sponge and the shower-bath, the pastile hides the want of ventilation, the otto of roses seems to render the scavenger unnecessary, and a sprinkling of musk sets all other smells and stinks at defiance."

I am afraid that vinegar, which, since the days of Howard, has been the favourite of amateur sanitarians, must be regarded as a deodorant only. All prisoners used formerly to be washed with vinegar before they were brought from gaol to the court for trial.

I have spoken perhaps at sufficient length on the disinfecting power of the air by oxidizing organic matter, especially when aided by sunlight; and heat and cold are

two other natural agencies which act in the same direction. Fetid gases are given off much more freely from decomposing animal and vegetable substances in summer than in winter, for cold, as is well known, has powerful preserving properties. In Siberia, elephants of extinct species and dead for many centuries are found in masses of ice, so well preserved as to afford very acceptable food for the dogs; and, on the other hand, a high atmospheric temperature is said to be also disinfectant, but it may be merely so by increasing aërial circulation, or probably by the humidity of the air lessening, and the conveyance of contagious particles being thus checked. Dry hot weather, it is well known, is less favourable than close moist weather to the development of stench from putrefying matter. The contagion of plague is destroyed by a temperature of 120°, and this fearful disease does not infest Egypt during the very hottest months. The clothes of plague patients, after being heated to 167°, were worn for fourteen days without injury. I will now refer, but very briefly, to some of the most reliable chemical substances for artificial disinfection of rooms and spaces where the seeds of disease may be supposed to linger.

Finely-powdered charcoal obtained from animal substances, peat, or wood, has great disinfecting influence upon organic effluvia, and it should be hung in bags through the place which it is desirable to purify. It acts by the oxygen it condenses on its surface, which is so extensive that a cubic inch of charcoal is said to equal in superficial extent 100 square feet. Peat charcoal, so readily procurable in this country, is most inexpensive and efficient, and by Dr. Stenhouse has been applied in situations ranging from sewer-traps to respirators. Dried earth is said to have similar but much more feeble powers. Lime is useful in removing carbonic acid and the watery vapour which contains the organic matter. Whitewashing is so desirable in point of cleanliness and cheerful-

ness that I am sorry to have a word to say in disparagement of it: but as many sanitary amateurs place their whole faith upon it, and seem to think that it supersedes all necessity for any other measure, I should impress on you that its sole action is to absorb carbonic acid, which, however, is not so pressingly necessary, as it so readily diffuses, and in small proportion is not very hurtful. I think a little chloride of lime might be added to the lime with advantage. Condy's fluid is a solution of permanganate of potash of a beautiful purple colour. It rapidly oxidizes organic matter, and many hurtful gases becoming thereby decomposed, the black oxide of manganese being thrown down. Exposed in saucers through a room it may, or thrown through the air as by a jet, it would very effectually purify the atmosphere, and if sprinkled upon the floor might act in the same way. Rinsed in the mouth it takes away the smell of tobacco. Sir Wm. Burnett's solution of chloride of zinc is very active for a short time, but it loses its power of absorbing sulphuretted hydrogen when it becomes acid in reaction. Chlorine gas is the most effectual destroyer of sulphuretted hydrogen, as it rapidly unites with the hydrogen, precipitating the sulphur in fine powder, and of organic matter, which it bleaches, deodorizes, and probably decomposes by abstraction of hydrogen. The easiest way to evolve it is to mix two tablespoonfuls of common salt, two teaspoonfuls of red lead, and half a wineglassful of strong oil of vitriol in a quart of water. The bottle must be kept cool, tightly stoppered, and in a dark place. A little of this fluid exposed in a saucer, sprinkled on the floor, or soaked in sheets of old linen and hung about the room, rapidly deodorizes and destroys effluvia. It has been lately explained that chloride of lime is a disinfectant by giving off hypochlorous acid rather than chlorine; and it is, therefore, better to disinfect with it by the addition of an acid, than to make simple chlorine from hydrochloric acid and oxide of

magnanese. The hypochlorous acid acts as a powerful oxidizer and destroyer of organic poisons; but chlorine mainly by being changed in moist air into the hypochlorous acid. Both for disinfecting solids and air when it evaporates, iodine has been much made use of latterly; with methylated spirit its tincture can be prepared for about six or seven shillings a gallon. Bromine has been also recommended. Nitrous acid gas has a powerful oxidizing action on organic matter and on sulphuretted hydrogen, but is objectionable on account of its own fumes, which often excite coughing. It is disengaged by heating nitric acid, to which a few copper slips are added in a retort. It is not used as much as it deserves, and in typhus and cholera, for the purpose of destroying, in rooms or on clothes, the animal emanations which constitute the poison of those diseases, no agent is more reliable. Either this gas or chlorine should be plentifully evolved in foul privies, especially during warm weather, and when dysentery or diarrhœa are prevailing. The frequency of these diseases has thus been often diminished.

Sulphurous acid, made by throwing sulphur in a brazier of burning coals, has been used since the days of Homer for the purpose of disinfection, and it acts by preventing the growth of the lower forms of life. You may have heard that there is a disease of the human stomach in which small plants (Sarcina) are generated in myriads, and then thrown up. A dose of a sulphite, which evolves sulphurous acid, cures it most efficiently. It is a most powerful destroyer of fetid gases, but it has the disadvantage of bleaching and rotting clothing.

The disinfection of rooms requires then some skill, and should be done by properly instructed persons, and that careful supervision is necessary will appear from the following instance. Small-pox rages in New York, and is conveyed to many adjoining towns owing to carelessness of vaccination and the spreading of the conta-

gion by clothes. As an instance of the preventive measures actually in force, hear the report of the Council of Hygeine:

"As the result of searching inquiry into the history of more than 1,200 cases of this dreadful disease during the early part of the winter, 1865, the Inspectors found but two instances in which the infected domiciles had been visited by any officer or *employé* of the Health Department of the city government. In one of those instances the so-called Health Warden stopped at the foot of a stairway forty feet distant from the poor tenant who had the disease, and delivered his orders as follows: 'Put pieces of camphor about the clothing of those who are not sick, and occasionally throw some camphor upon the hot stove.' In the other case the sanitary officer of the ward called at the entrance of a tenant-house in a densely-crowded district, and instructed the poor families whose domiciles were smitten with the contagion, that they must not permit any person to know or to mention that there was small-pox there, and that if that injunction of secrecy were not strictly obeyed he would send them all to the pest-house!"

2nd. The purification of water having been before discussed, I will only here repeat that boiling is the surest and simplest remedy, that charcoal or magnetic oxide of iron is the best filtering medium, and that Condy's fluid may be safely added to drinking water in the proportion of about a teaspoonful to a gallon, as an excellent way to remove organic matter. The manganese thus introduced into the system is no way injurious. For cleansing cisterns, mechanical means—such as scraping if they be cement or stone, or charring with lighted shavings of wood—may be also used. The crimson and stronger Condy's fluid sells at 10s. per gallon.

3rd. The disinfection of sewage and solid matters harbouring disease. Although carbolic acid is only recently talked of as a disinfectant, under the form of creasote and the gases evolved from tar and pitch when burning, it has been used as such from time immemorial, and the efficacy of smoke in preserving meat is due to it. It does not act by retarding oxidation, as Mr. Crookes has conclusively proved, but with regard to

the fermentative process, "it not only arrests it instantly when in progress, but it prevents the development of future fermentation." While it does not interfere with purely chemical ferments, as diastase, it checks those which depend on, or at least are accompanied by the production of minute plants or animals. The minutest trace spoils vaccine lymph, which surely must be allowed to be an animal ferment, as it does the vegetal ferment in the brewer's vat. It may well deserve the name, therefore, of "anti-zymotic." For the deodorization and disinfection of sewage and other manures, this property is most valuable, for while it checks the fermentation which wastes these valuable products, it causes the retention of the nitrogenous matters. Mr. Crookes details many practical trials upon the preventive power of carbolic acid against cattle-plague on various farms. Those at Peckforton Castle, Cheshire (the seat of Mr. Tollemache, M.P., who courteously gave me facility for studying the disease in that neighbourhood last January), strike me as most conclusive.

One of the first facts observed by Mr. M'Dougall and Dr. Angus Smith, who first used the mixture of carbolates and sulphites, was that manure heaps, if mixed with some of it, did not heat and did not attract flies. This might be explained by the supposition that putrefaction encourages the generation of the minute forms of life on which the flies feed. Dr. Smith many years ago threw out the idea that the injurious nature of low-lying lands might be attributed to the great abundance of organic life, when compared with that to be found about high and drained places. The result of the experiments of this eminent chemist in preserving meat was to show that cresylic and carbolic acids, both of which are contained in creasote, had the highest antiseptic powers. They act by preventing the development of low forms of life, which, however, according to Pettenkofer, begins when they are removed. But this want of continuous action

is even more true of oxidising agents, such as chlorine. Dr. Smith has suggested the appropriate term of *colytic* (κωλύω, *I arrest*) to express an agent which checks this development, the word catalytic having the signification of promoting chemical change. Common salt, which has the oldest repute for preserving meat, is very suitable for preserving refuse, and it is cheapest.

The neutral metallic salts, chloride and sulphate of zinc, and sulphate of iron, are powerful in checking putrefaction, as was first proved by Falcony, who mixed the first with sawdust round dead bodies, and thus preserved them for months.

Dr. Rollestone, F.R.S., Professor of Physiology at Oxford, in commenting on Pettenkofer's essay on cholera, argues that a considerable time, even many years, must pass before the organic matters in the soil are so decomposed that the cholera germ can no longer develope itself when other necessary conditions are present. The sewering of cities is a most desirable thing; but Pettenkofer advises us, in the face of an impending cholera epidemic, to starve the cholera germ by destroying the alkalinity of the sewage. We are, by all means, to avoid any further impregnation of the earth around our dwellings with sewage; but it would be as foolish for us to expect that, by putting sanitary measures and sewage in force on the spur of the moment, we can nullify the impurities which years of neglect have accumulated and infiltrated all around us, as it would be for a repentant drunkard to expect that his fluids and tissues would become renovated on the instant of his taking the pledge. Much good may, it is true, be done even at the moment by abating local nuisances; but they can only be abated at the moment—they cannot be nullified; whereas the personal element of a specific poison can be destroyed in the excreta by the employment of acidifying disinfectants. Sanitary measures may ultimately prove omnipotent against epidemics; but they must have time allowed

them to acquire it. Copperas is cheap, and most certain for preserving an acid state of sewage, which Pettenkofer thinks preventive of cholera development. Chloride of lime favours the alkaline state. Dissolved in its own weight of water, copperas should be placed in every vessel used by a cholera patient, and it then destroys the excreta by which the disease is propagated. These measures require to be carefully attended to, and when they have been, as at Zwickau, a most rapid cessation of the disease has resulted.

With regard to clothes and woollen articles, there is much evidence to warrant us in saying that such highly communicable diseases as cattle plague and small-pox are so conveyed, and the Custom-house officers at London have contracted skin diseases from examining bales of rags. Outbreaks of small-pox in paper factories have been also traced to infected rags. Lord Brougham made public a statement that the clothes from the small-pox and fever hospitals of London were carried in a cart common to those of other institutions and private families to be washed in the centre of the city, and that two of the carters had caught the small-pox. The statement was denied on the part of the Fever Hospital, but not on the part of the Small-pox Hospital. The infected articles should be washed on the premises of the hospital, or disinfected, so as not to endanger the public safety. Dr. Furman, of New York, says:

"In the spring of 1861, we had occasion to attend a young gentleman with small-pox, who was clerk in a banking house. Where and how he contracted the disease was unknown to him; but several weeks after his recovery he learned that he had opened and counted, a few days before his sickness, a large package of money forwarded by a Western bank, whose cashier, residing in the bank building, had recently suffered from the small-pox."

In my lecture on cholera I gave you an instance of which clothes seemed to have carried the contagion in cholera for a distance of half-a-mile or so, and similar

instances are recorded in great numbers; but I confess I know of no evidence to show that imported clothes or those carried considerable distances conveyed the disease. It is right, however, to be on the safe side, and by the Sanitary Act, the local authority is bound to provide disinfecting apparatus; but it cannot be legally used unless proof is given that the articles are infected, and this is very hard to get.

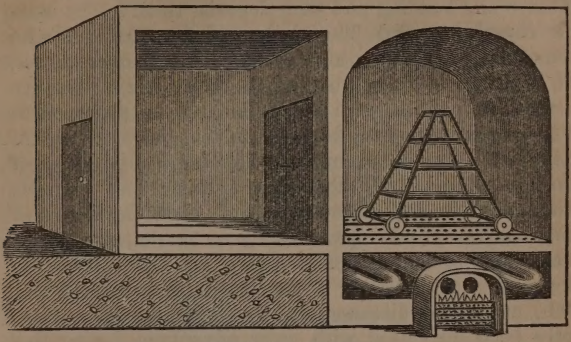
It was the late Dr. Henry of Manchester who, being called on to apply some method of disinfection to cotton supposed to be infected with plague, suggested the use of heat, as that disease disappears when the temperature rises. He himself wore clothes from typhus and scarlatina patients after they had been exposed to a heat of 200°, and did not contract either disease, and vaccine lymph was rendered useless in the same way. Dealers in feathers use the same purifying means. The principle of heating in an oven, or double iron box with air between the walls, has been applied in Christ's Hospital, Guy's Hospital, Bristol Infirmary, and combined with the burning of sulphur has been adopted in many workhouses; and it is most efficacious in destroying vermin, including the itch-mite. Dry heat is superior to that of boiling water, as infected clothes are said to have communicated fever after they were immersed in that fluid. Such an apparatus should be connected with every public washhouse, and in that case would not be expensive.

Shortly after the appearance of cholera, the Public Health Committee ordered the construction of a hot-air chamber. The site of the chamber originally fixed on was the mortuary house in Fishamble-street, which had been erected last year, but abandoned at the petition of some ratepayers in the neighbourhood who objected. I advised the use of this building, as many weeks and much expense would be saved, and as it is in one of the most uncared-for districts abounding in cholera and

fever nests, and not far from the fever hospitals or the river, along which imported clothing might be carried for purposes of disinfection. However, while it was being erected, the influential and, I regret to say, intelligent persons connected with the locality strongly pressed on the Corporation, who were forced to yield, and the apparatus, then abandoned, was therefore not in readiness until after the disease had ceased. I do not hesitate to declare publicly that I believe many deaths by cholera may be attributed to this unreasoning and selfish opposition. I am sure that no one who understands the construction of the chamber, and the way in which the process is conducted, can believe that the slightest danger can befall any one resident near to it, much less a passer-by. If there could, surely no condemned felon, even for a reprieve, would undertake the duty of placing the clothes in the chamber; and yet there were at the time these objections were urged candidates for the office. It was asserted that a panic would arise in the neighbourhood. This I thought most unlikely, but the residents would have been to blame if it did. An agitation was most perseveringly got up; and a large placard, announcing that the place was "opened for the spread of cholera," having been pasted on the door by some ill-disposed person, was allowed by those living near to remain up during the whole of one Sunday. The building could then have been ready in fourteen days; but as it was abandoned, a delay of some months occurred in getting another site and constructing the necessary works. The committee failed in obtaining several sites, for the same selfish reasons and misconceptions prevailed elsewhere against their benevolent efforts to preserve the health of the poor.

I will shortly describe its construction, which will be readily understood from the accompanying diagram. One end of the building is shut off from the larger room by a cast iron door, and the chamber so enclosed is 12

feet by 10, and 8 feet high; its walls and roof are of brick, and the floor perforated metal. Under this floor



Disinfecting Chamber.

there are coiled 9-inch iron pipes, 80 feet in length carrying heated air and smoke from the furnace, by which the temperature of the chamber is raised to from 240° to 300°.

A high flue is erected, so as to produce no inconvenience from smoke. With the same object coke is burned in the furnace, which is not larger than an ordinary boiler furnace. The covered cart containing the clothes or bedding is brought within the building before they are removed. They are then placed on horses or shelves within the chamber, and heated for three or four hours, and it has been positively shown that all organic or infectious matter must be destroyed at the end of this time. No effluvia whatever, except the smoke of the fire, passes through the pipes or escapes from the chimney. The articles which are disinfected in it come from three sources. 1st. Clothes from England; but as the Sanitary Act requires proof of their being infected, and as this will be difficult to obtain, very few bales can be retained. 2nd. The bedding and clothes of persons re-

moved to hospital with contagious diseases. The same vehicle which conveys the patient to hospital carries the clothes and bedding and then deposits them in the hot-air chamber. 3rd. The clothes of poor persons who remain at home when afflicted with contagious disease. If, under these circumstances, they die, their clothes are usually sold and disease is thus extensively propagated. Three such chambers have been for years in use in Liverpool—two in the midst of the crowded buildings of the Brownlow-hill Workhouse, and the third in the densest part of the city—Ford-street, between Vauxhall and Scotland-roads. No panic has ever arisen, nor has a single case of illness been produced, but there can be no doubt that many cases of small-pox, scarlatina, fever, itch, and other diseases have been prevented. They have been also used with great advantage during the cholera epidemic, 14,218 articles of bedding or clothing from infected houses having been gratuitously purified. By the 23rd section of the Public Health Act, the local authority is called on to provide disinfecting apparatus, and no other means than a hot-air chamber will be effectual or will save the fabrics. Such is recommended by the Poor Law Commissioners, and steps were taken in several Irish towns to erect them when cholera threatened, but as the danger became less their ardor cooled. If the local authorities were careless of public health, the erection of such an apparatus could be enforced by higher authority. The present site in Marrowbone-lane seems very suitable from its position with regard to the fever hospital, and from being in the midst of a district where preventible diseases are, unfortunately, always rife. The building is also surrounded by very free-air space, and being on a Corporation yard, will be always under control of reliable officers. The chamber has been only just completed, so that I cannot speak from any large experience of its efficacy, but I feel sure much benefit will arise. If its present site be found inconveni-

ent, I would advise the construction of a movable iron chamber which might be drawn by horses from place to place.

In London, no disinfecting chambers being prepared, they burned all the infected bedding and clothing, paying the value to the poor owners. At Sydenham a kiln on high ground was used for the purpose.

The conveyance of persons suffering from contagious diseases in cabs and other public vehicles is very improper. I have no doubt that small-pox and scarlatina are frequently thus contracted. A well-known London physician employed a cabman to take him to a patient's house. As he was alighting the driver said, "I think its small-pox that ails the lady; for last week I brought her here just after I had left a case at the Small-pox Hospital"—and such was her disease, and so contracted.

In this city the hospital patients are conveyed in special vehicles, but many a patient with catching diseases is necessarily conveyed in our cabs. It would not, of course, be well to interdict cabmen from conveying sick persons altogether; for distinctions are hard to make, and regulations of the kind would probably lead to extortion from this class, which is not proverbial for civility. The means of disinfecting these vehicles which should be employed, would prevent their use for some hours, and would very probably stain or rot their linings, so that the best remedy for the difficulty is that directed by the 12th section of the Nuisances Removal Act, 1860, namely, the provision of special vehicles, which the public should be urged to use when an occasion arises.

It may not be out of place to quote some of the directions which were most extensively issued on the outbreak of cholera last year. After some information with regard to dispensary and hospital relief and treatment meanwhile, it was advised:

"4. Keep the windows open, or partially so, not only in sick rooms but in all rooms, even at night; sprinkle the floor with

chloride of lime mixed with water; soak all clothes which may have been about the patient in the same mixture, and place some of the chloride of lime in any vessel which is to be used to receive the discharges from the patient, which should be then placed in the privy. Landlords of tenement houses should keep a supply of chloride of lime in the basement storey and yard.

"5. While there is danger from cholera, everyone's diet should be moderate—fruit, fish, or other foods not perfectly fresh, should be avoided; great temperance should be observed, and the water used for drink should be previously boiled, and, when cold, tossed between vessels to restore its taste. Food should not be taken in the sick room, nor until the hands of those who have tended the sick have been washed with chloride of lime and water.

"6. All rooms and yards should be whitewashed, privies and ashpits cleansed, collections of filth or stagnant water removed, and the openings of sewers trapped with water valves.

"All complaints lodged at the Office of the Inspector of Nuisances, City Hall, will be immediately attended to.

"Clergymen and all parochial visitors are earnestly requested to aid in the circulation of the above recommendations, and use their influence in carrying them out."

The address of the disinfectors was then given, and it was stated that they would at all times act at the request of the relatives of the person attacked, of the physician, or clergyman. The course pursued by these officers was to urge removal to hospital, and give the necessary advice for the purpose, and if this was agreed to, the room and all apertures being closed, it was then filled with chlorine gas disengaged from chloride of lime by pouring vitriol on it. On the third day all the windows and the doors were opened, and after the seventh its habitation was again permitted. The greatest benefit resulted. If the patient was not removed, the only steps they were able to take were throwing of chloride of lime on the privy, and about the passages, and advising free airing of the room.

As soon as the epidemic had ceased, the disinfectors returned upon all the houses where cholera cases had occurred, and threw upon the privies and into the sewers a mixture of carbolic acid and concentrated solution of copperas, which seemed to me most calculated to

exterminate the seeds of the disease, which might lurk in sewage.

I should also mention that the sewers and street channels in the infected streets, and indeed in all the poorer neighbourhoods, were flushed freely with weak solutions of chloride of lime, and afterwards with carbolic acid, as soon as an ample supply of that agent was procurable. The removal of filth, when cholera had broken out in a house, was not allowed until disinfection had been performed. Dry earth, ashes, or, still better, peat mould, was most useful for this purpose, as it dried and deodorized the refuse before it was carted away.

LECTURE XXI.

VITAL STATISTICS OF IRELAND—SYSTEMS OF REGISTRATION—THE MORTALITY OF DUBLIN.

It seemed to me that the course of lectures which it has been my pleasure to deliver to you would be incomplete if I did not endeavour to give you some succinct view of the present status of disease in Dublin and Ireland generally. This I am enabled to do by those admirable statistical reports which, for the last three decades, the Registrar-General and Sir Wm. Wilde have prepared from the Census returns, and by the registers of deaths which are now systematized so ably with the co-operation of the Medical Registrar, Dr. Burke. With very great readiness the general public have given the data for preparing these returns, and these distinguished public servants most amply repay the trouble, for whenever they believe that benefit can arise they most willingly allow their information to be utilized for the public good. What death-returns indirectly imply, a great statesman forcibly expresses. Lord Stanley remarks:

"Dry and unattractive as sanitary studies may appear, they belong to the patriot no less than to the philanthropist; they touch very nearly the future prosperity and national greatness of England. Don't fancy that the mischief done by disease spreading through the community is to be measured by the number of deaths which ensue—that is the least part of the result, as in the battle the killed bear but a small proportion to the wounded. It is not merely by the crowded hospitals, the frequent funerals, the destitution of families, of the increased pressure of public burthens, that you may test the sufferings of a nation over which sickness has passed; the real and lasting injury lies in the deterioration of race, in the seeds of disease transmitted to future generations, in the degeneracy and decay which are never detected till the evil is irreparable, and of which, even then, the cause remains often undiscovered."

The diseases or infirmities under which the people of this country laboured when the Census was taken in 1841, 1851, and 1861, were wisely divided into—1, those of a permanent nature, as deafness, muteism, blindness, lunacy, idiocy, paralysis, epilepsy, lameness, and decrepitude; and 2, the temporary, which included all the ordinary acute and chronic complaints. Much accessory information has been given by the Commissioners:

"Viewing a census in the light of a social survey, in which the condition as well as the enumeration of all classes of the people should be considered; and believing that a knowledge of the nature, causes and extent, as also the distribution and results of the epidemic diseases of this country may tend to assist the legislature in future sanitary investigations and improvements, not only in the necessary provision for the destitute, but also in supplying suitable relief to the suffering."

With regard to the first disability, inquiries were made

"Whether the person was born deaf and dumb, or became so afterwards; to what cause the malady was attributed; whether the persons so returned were paralytic, idiotic, or in any other way mentally or physically affected; whether other members of the family, either of the present or previous generation, had been mute; and also as to the education, social condition, and other circumstances, of all the persons so returned."

The proportion of those born deaf and dumb to the population of Ireland was, in 1851, 1 in 1,573, and in 1861, 1 in 1,370.

The increase in the last year appears to be due to the emigration, which drained off the healthy, leaving these afflicted persons at home or in public asylums. Many noteworthy results were afforded by this searching investigation into the circumstances of the deaf and dumb, and they prove, contrary to the opinion now pretty general in France, that marriages of consanguinity are productive of deaf and dumb offspring. Six mutes in a family occurred five times, and seven in one case, in

which "there was neither hereditary predisposition nor any other probable physiological or pathological reason assigned to account for this very remarkable peculiarity." The *Status of Disease* part of the Report for 1851 records a remarkable case in which the parents were third cousins, and had seven mute children, all females, six of whom were twins. A more recent inquiry ascertained that only one of these now survives, and that this family had eight deaf and dumb children born in it. In families having a single mute it was most generally a first child, and mutes were most frequent in families of six or seven.

In 1851, there was 1 blind person to every 864 of the population—a proportion which is larger than most other countries, and due to the ophthalmia which had prevailed epidemically during the years succeeding the famine, for want of food is especially apt to give rise to destructive disease of the eye. I may mention that in Norway, where the food is very poor in nitrogen, the proportion is 1 in 540, and in the United States, where it is the contrary, but 1 in 2,489. The last census gave a higher proportion—namely, 1 in 843—in this country than in 1851; but, like deaf-muteism, it depended on the blind not having emigrated in ratio to the healthy population. The proportion of lunatics to the whole population is 1 in 821, while in 1851 it was reported at 1 in 1,291. Compared with other countries, Ireland occupies, together with Nova Scotia, Sweden, and Bavaria, a medium position between the high rate of lunacy in Prince Edward Island, Oldenburg, and Denmark—the average of which countries is 1 in 477 of the population—and the minimum proportion, which is in Piedmont, Savoy, Holland, and Saxony, where the average ratio is but 1 in 1,931. That there are 1,991 more persons now in Ireland afflicted with lunacy than in 1851 is a fact of the gravest import, although the imperfection of the method of acquiring information in the

former census in this particular may have been defective, and the nature of the Irish exodus, to which I have before alluded, may have falsified the returns as comparative surveys. With regard, then, to permanent infirmities, the following summary gives the comparative results of the two censuses :

		1851.	1861.
Deaf and Dumb, one person in	..	1,265	1,026
Blind, „	..	864	843
Insane, „	..	1,291	821
Idiotic, „	..	1,336	825
Lame or Decrepit „	..	1,498	1,408

The statistics of the various prisons are given very fully in the Census Report, and the very learned physician who reviewed it in the *Dublin Quarterly Journal of Medical Science* makes the following judicious remarks :

"It were well if some inquiry were made as to the vital statistics of the sanitary and mental condition of convicts, as resulting from their very hopeful position. By this we mean any record of how much bread, meat, porter, pudding, and other good things they get; how many hours they labour during the day, and the amount of work done, as compared with the working hours and work done by honest *adscripti glebæ;* how much clothing, good housing, cleanliness, and amusement is inflicted on these wayward children by a paternal government; in fact, how much inducement is held out to the honest man to become a rogue."

Despite all these advantages, we find that disease was most prevalent—1 in 10 of the prisoners having been under treatment; and the same writer exclaims :

"If all these gentry had been formed into a rogue's brigade, and sent into the trenches before Duppel, or subjected to Prussian tender mercies elsewhere, we might not wonder at the sick in hospital being reported as 1 in 10; but so large a proportion of sick in our quiet prisons at home, with protection from wind and weather, warm clothing, wholesome food, plenty of cleanliness and idleness, a little moderate exercise, and good medical attendance, forcibly suggests some queries to the medical reader. Are the prisons unfit for habitation, as in the days of Howard? Are the clothing and food insufficient or of bad quality, as at the

Crimea? How much or how little illness secures a remission of that terrible judicial sentence, 'hard labour?' To what extent does malingering prevail in our prisons? and what sort of pigmies are the natives of the various localities robbed, burned, or otherwise injured by this decrepit set of prisoners?"

With respect to the outdoor employment of prisoners in agricultural work, Inspector-General S. Clarke remarks:

"A more healthy-looking body of labourers could not be seen than the prisoners employed on the convict farm at Dartmoor and on the works at Portland, in England, and Spike Island, in Ireland, Those employed at the Smithfield and Lusk Intermediate Prisons in Ireland appear like so many free labourers, with the exception that they carry on their work in a quieter and more orderly manner. In walking over the convict farm at Lusk, the first feeling is astonishment, that a system which appears to work so well should not have been more widely adopted; and the next is, that it must sooner or later become general."

You will readily understand the difficulties which surrounded the collection of trustworthy returns of those sick of various temporary diseases on the night the Census was taken, but they are, I am sure, sufficient accurate to allow us to derive conclusions as to the increase or decrease in various diseases in 1861 as compared with 1851.

I. ZYMOTIC.		
Ord. 1.—*Miasmatic.*	1851	1861
Small-pox	888	116
Measles	1035	1308
Scarlatina	324	266
Quinsy	80	176
Whooping-cough	359	153
Fevers	13777	2350
Erysipelas	256	228
Ophthalmia	3883	1307
Influenza	—	2330
Dysentery and Diarrhœa	9729	1139
Ague	201	81
Rheumatism	3953	4103
Ord. 2.—*Enthetic.*		
Syphilis	824	370
Ord. 3.—*Dietic.*		
Privation	191	6
Purpura & Scurvy	149	101
Dyspepsia	345	526
Ord. 4.—*Parasitic.*		
Itch	1193	397
Scald Head	2042	276
Worms	283	259
II. CONSTITUTIONAL.		
Ord. 1.—*Diathetic.*		
Dropsy	1464	952
Ord. 2.—*Tubercular.*		
Scrofula	2654	1615
Wasting	747	275
Consumption	4182	2650

This I have done in the foregoing epitome of the number of cases of the most important diseases of the zymotic and constitutional classes, which mainly have concerned us in discussing Preventive Medicine.

There is growing up among statists a very general impression, that a Census taken every ten years is very fallacious; and certainly, for the greater number of the intervening years, it is very hard to strike an accurate death-rate, or in any other way to test the rate of sanitary progress. It is usually done by calculating the increase or decrease during the previous decennium; but in this country such a means is palpably fallacious. On the appearance of the Census the calculations made on the above mode of correction are often shown to be widely astray.

The proportion of males to 100 females over the whole of Europe has been lately estimated at 106, ranging from 108·9 in Russia to 104·7 in Great Britain.

I will now give you a very brief sketch of the two schemes of nosology, or the arrangement and classification of diseases which are used by the English and Irish and by the Scotch Registrars, both of which differ very considerably from that adopted in the Census reports we have just analyzed. The inconvenience of this is obvious, and it would be most desirable that before the next Census, at least, they should be similarized. The classification originally proposed by Dr. Farr twenty year ago, seems to me as nearly perfect as the state of medical science then permitted; but it now requires readjustment, and I understand such is contemplated by the co-operation of such authorities as the Medical Registrars of the three kingdoms, and the Medical Officer of the Privy Council, Mr. Simon. I am sure that no classification which will require essential changes with the progress which we may confidently trust medicine will yearly make, will be adopted by this congress of the medical statists, for otherwise much confusion would

result, and useful and accurate comparisons of the status of disease could not be conveniently made with previous years. Dr. M. d'Espine of Geneva, has for many years followed the following classification, which professes to be arranged upon physiological data: (1) still born; (2) deaths soon after birth; (3) deaths from *age;* (4) death from violence or *external* accident; (5) *sudden* deaths from internal causes; (6) deaths from *acute* diseases; (7) from *chronic* maladies; (8) undetermined. Meanwhile, the issue of the "Statistical Nosology" by the Registrar-General of Ireland was necessary, in order to get returns at all intelligible or classifiable. I may here mention that I think the willingness with which returns have been made has been due to the very great respect in which that gentleman is held, for the extraordinary zeal with which he has devoted himself to arranging the statistics of this country entitle him to national gratitude. Most of the medical institutions have lent him their aid; for instance, the great body to which it is my pride to belong, at a meeting of the Council, held on the 3rd of March, 1864, resolved:

"That we, the President, Vice-President, and Council of the Royal College of Surgeons in Ireland, deeply impressed with the importance and value of the lately enacted measure for the registration of births and deaths in this part of the United Kingdom, and anxious to have its provisions fully and accurately carried out, do resolve to promote, as far as possible, the objects of the legislature, and earnestly recommend the Fellows and Licentiates of the College to assist the authorities in procuring the statistical information required under the Act."

In the Registrar's Nosology, the diseases which produce death are divided into five classes, which are each subdivided into orders, of each of which I have given but one example to save space. If I have set down a second disease under some of the orders, it is because I have afterwards a remark to make upon it:

I. ZYMOTIC DISEASES.

		Example.
1.	Miasmatic Diseases	Small-pox, *Fever*.
2.	Enthetic „	Syphilis.
3.	Dietic „	Scurvy.
4.	Parasitic „	Worms.

II. CONSTITUTIONAL.

1.	Diathetic Diseases	Cancer, *Gout*, *Dropsy*.
2.	Tubercular „	Consumption, *Goitre*.

III. LOCAL.

1.	Diseases of Nervous System ..	Apoplexy, *Convulsions*.
2.	„ Organs of Circulation ..	Aneurism.
3.	„ Respiratory Organs ..	Bronchitis.
4.	„ Digestive Organs ..	Inflammation of Stomach, *Painter's colic*.
5.	„ Urinary Organs ..	Bright's Disease.
6.	„ Organs of Generation ..	Ovarian Dropsy.
7.	„ Organs of Locomotion ..	Inflammation of joints.
8.	„ Integumentary System ..	Ulcer.

IV. DEVELOPMENTAL.

1.	Diseases of Children	Teething.
2.	„ Adults	Childbirth.
3.	„ Old People	Old Age.
4.	„ Nutrition	Debility.

V. VIOLENT DEATHS.

1.	Accident or Negligence	Burn.
2.	Battle	Wound.
3.	Homicide	Poisoning.
4.	Suicide	Drowning.
5.	Execution	Hanging.

Other Violent Deaths not classed.
Sudden Deaths, cause unascertained.
Causes not specified or ill-defined.

To the classes I do not think any objection could be made, and it is of the utmost importance that preventible maladies, although of different seats, should be grouped under one head, such as "zymotic." The subdivision into orders is likewise very scientific, and it is only with regard to the places which a few diseases occupy that I would venture suggestions. I think, for

instance, that it is high time we should have deaths from typhus and typhoid fevers recorded separately. From the diathetic order of constitutional diseases I would remove gout to the dietic order of the zymotic, for it is evidently due to circumstances of food or drink. Dropsy is a most inaccurate term, under which deaths from diseases of the heart, liver, kidney, &c., are confounded. As convulsions, that destroyer of infants, is usually due to reflex disease excited by bad air or improper food, I would be glad to see it under the zymotic head. Goitre is surely misplaced in the tubercular order, and for reasons I have so often mentioned appears clearly dietic. And, lastly, I think it would be advantageous to group painter's colic, which is now registered among the local diseases, with other very preventible ills which arise from special occupations, as steel-grinding, mining, and mirror-silvering, under some such title as "Industrial." As the public should share in the information collected by registration, I am in favour of using popular terms, if as accurate as technical ones; for instance, consumption and water on the brain are surely as suitable terms as phthisis and hydrocephalus, though less pedantic.

The system proposed by Dr. Stark, the Scottish Medical Registrar, tabulates every disease under the "organ of the body which was primarily and chiefly affected," and an example or two from the remarks with which that physician elucidates his plan will make its principles more clear:

"According to the rule laid down, therefore, diphtheria must either be classified under diseases of the organs of digestion, or where I have provisionally put it, under fevers. It seems to me to be so closely allied to cynanche maligna and cynanche tonsillaris, both of which are undoubted forms of scarlatina, that it seems to me we have no choice left us but to place it after scarlatina. For statistical purposes there can be no such class allowed as the tubercular; it would violate all our rules. Every disease now put under that class must be referred to the organ of the body chiefly affected; so phthisis must be referred to diseases of the respiratory organs; hydrocephalus to diseases of the brain; tabes mesenterica to diseases

of the organs of digestion. Whooping-cough and croup are so purely diseases of the respiratory organs, the wonder is they were ever put elsewhere. Diarrhœa, dysentery, and cholera, may be called the leading diseases of the organs of digestion, and that is their undoubted proper place."

This extract exhibits the merits or demerits of this plan at large; but I must say that while the advantages of classifying diseases according to their precise seat, if always ascertainable, are not very evident, the disadvantages of separating those which owe their origin to similar morbific agencies and are preventible by similar measures far outweigh them.

Sir Wm. Wilde's investigations brought to light in 1841 the suggestive facts that there was in Dublin the most astounding difference in the death-rates of the first class squares and streets, in which it was but 1 death in 122, and such poorer districts as St. Paul's, Linen Hall, and St. Catherine's, in which it was 1 death in 37, 42, and 43 of their denizens respectively. It is much to be feared that these proportions have not been much equalized as yet, but the accurate mortality returns we now have will guide our efforts in these directions. Dr. Dundas Thompson showed the same for London district:

"But if a low death-rate may be considered as an indication of the healthiness of a locality, then will the Cavendish-square district, with its 15,000 inhabitants, stand pre-eminent amongst the other parochial districts. By this rule of estimate, which I think must be regarded as a fair one, it will be found equal in salubrity to Hampstead, and superior to every other district of London, equal also to the healthiest parishes in the healthiest counties of England, and considerably above Brighton, Margate, Ramsgate, and many of our most frequented and attractive watering places; and why it is so may be very easily and satisfactorily explained. Its poor population is very small, and there is but little overcrowding; its streets are wide and airy; its houses for the most part large, commodious, well built, and ventilated; its drainage good, and with a considerable fall into the sewers; its water-supply abundant, owing to the ample cisternage of most of the houses, and beneath its surface lies a substratum of fine sand, which not only preserves dryness, but constitutes also an excellent medium for the infiltration of surface drainage."

It has been asserted also that Irish poor carry with them the disease-generating tendency with which they are afflicted at home into those English, and Scotch, and American towns into which they emigrate, or at any rate that the mortality of many of them is in proportion to the per-centage of our countrymen. In Liverpool, 18 per cent. of the population is Irish, the death-rate is 30 per 1,000. London has a much smaller proportion of our poor countrymen, its general death-rate is 23; and Greenock, with 12 per cent. Irish, loses 35 per 1,000 of her inhabitants annually, while Aberdeen, with 2 per cent. Irish, loses but 21.

Density of population undoubtedly increases mortality, and in that aspect Dublin is not healthy.

The Registrar-General, in 1865, stated the density of population in British cities was according to the follow-ratio:

Liverpool (borough) ..	93·3	Birmingham (borough) ..	41·9
Glasgow (city)	83·7	London	38·7
Manchester (city)	79·1	Bristol (city)	34·5
Dublin (city)	66·9	Salford (borough)	21·4
Edinburgh	42·5	Leeds (borough)	10·4

Another evil due to various unwholesome influences I have sketched in previous lectures, is the physical degeneracy of the poor classes in the more crowded parts of Dublin, apparent to any one walking through them. The stunted proportions and listless aspects of the adults, and the pale scrofulous faces, full of precocious knowingness, of the children, contrast more widely than, perhaps, in any other country, with the stalwart build or ruddy cheeks of the surrounding rural population. Those city influences which induce an early puberty, and a consequent arrest of growth, are probably unavoidable in dense populations, but among causes of urban degeneracy which are preventible, rank, ill-chosen, and ill-prepared food, scanty supply of cow's milk, inability for breast nursing, alcohol, impure air, &c. Infants are so sus-

ceptible to unwholesome influences that mortality among them affords a most sensitive test of the public health of any district. In 1844, over 40 per cent. of the children of the labouring classes died under five years. Early mortality is not, however, the only ill effect of neglect of sanitary conditions, for those who survive linger out an unhealthy life, and propagate for generations their physical defects.

The Act for the Registration of Births and Deaths in Ireland, 26 Vic., cap. 11, came into operation on the 1st of January last, rendering it a legal offence for the relatives not to give notice of a birth within three months, or of a death within fourteen days. There are reasons for believing that it is now working with tolerable accuracy, at least in the cities. It was not to be expected that it would work with much accuracy at first; thus for instance: In January, 1864, the first month of registration, 649 deaths were registered, while the burials in the three city cemeteries of persons dying in the city were 896 in the same period.

From the Registrar-General's returns it appears that the number of births registered in Ireland during the year 1865 amounted to 145,227—74,481 males and 70,746 females; affording a ratio of 25·0 per 1,000 of the population, 5,798,967 in 1861. The number registered in 1864 was 136,643, or 23·6 per 1,000; thus showing an increase of 8,584 births between the two periods.

The deaths registered in Ireland during 1865 amounted to 93,738—46,569 males and 47,169 females; affording a ratio of 16·2 per 1,000 of the population. The number registered in 1864 was almost similar—95,075, or 337 more. During each of the three first quarters of 1866 there died respectively 27,824, 24,763, and 18,751.

The number of persons who left the ports of Ireland during the year 1865, according to the returns obtained by the Enumerators, amounted to 101,497; the

number during the year 1864 was 114,903. During each of the three first quarters of 1866 there left Ireland 25,889, 41,124, and 19,640 persons.

The registration in the western and north-western divisions seems most faulty, for in Ballyvaghan, for instance, the annual death-rate upon the returns for the June quarter was only 3·5 per 1,000, and in Dunfanaghy for the September quarter, 4·1 per 1,000, while it is universally allowed that the rate of inevitable mortality is 17 per 1,000.

The mortality of Dublin and some other cities for the past two years is shown in the following table, but being the seat of so many hospitals and deaths, and two workhouses containing each some 3,000 or 4,000 inmates, its rate is necessarily high:

	Population 1861.	Persons to acre.	Deaths.		Deaths per 1000	
			1865.	1866.	1865.	1866.
Dublin City ..	254808	66·9	6959	7571	28·	29·5
Dublin District...	314409	32·7	8151	9034	25·9	28·7
London District..	2803989	39·0	73460	80129	26·1	48·5
London (Central)	378058		9948	10282	26·3	27·2
Liverpool ..	476368	94·8	17290	20202	36·4	42·4
Glasgow ..	423723	85·4	13887	12745	32·7	30 07

In some of the provincial towns the annual rates for the last six months were as follows, but it is confessed that registration was faulty, and it will be seen, from the proportion of population per acre, that in some instances the surrounding district is included.

Belfast.. (11·9 to the acre) 24·4 | Cork .... (6·7 to the acre) 17·4
Limerick (5·80 to the acre) 18·8 | Waterford (1·7 to the acre) 26·2

This city is divided into seven districts, which may be named after the street in which the Dispensary station is situated. North Side—No. 1. Summer-hill District, containing the Mater Misericordiæ Hospital. No. 2.

Coleraine-street District, containing the Rotundo Lying-in Hospital and Jervis-street Hospital. No. 3. Blackhall-street District, containing the North Union Workhouse, Richmond Lunatic Asylum, and the Richmond, Hardwicke, and Whitworth Hospitals. South Side—No. 1. Meath-street District, containing South Union Workhouse, Cork-street Fever, and Stevens' Hospitals. No. 2. High-street District. No. 3. Peter-street District, containing the Meath, Adelaide, and Coombe Lying-in Hospitals. No. 4. Grand Canal-street District, containing Sir Patrick Dun's and St. Vincent's Hospitals.

The death-rates in these districts has been as follows:

	Deaths per 1,000 living	
	1865.	1866.
Summer-hill District	18·1	23·4
Coleraine-street	20·1	19·3
Blackhall-street	43·4	46·7
Do. abstracting workhouse deaths ..	31·2	28·1
Meath-street	45·4	46·9
Do. abstracting workhouse deaths ..	27·7	25·1
High-street	20·4	24·2
Peter-street	21·7	22·8
Grand Canal-street	17·54	17·5

During each of the quarters the annual rate of mortality was as follows:

	Deaths per 1,000 living	
	1865.	1866.
January, February, March	34·4	32·6
April, May, June	25·6	28·02
July, August, September	23·8	25·1
October, November, December	27·02	33·03

Zymotic diseases produced in each year 1,483 and 2,309 respectively, and the most prevalent of them may now be considered in detail. 492 deaths were due to fever in 1865, and 480 in 1866, distributed over the districts as follows:

	Per 1,000 living. 1865.	1866.
Summer-hill	7·7	6·8
Coleraine-street	3·9	7·01
Blackhall-street, containing the Hardwicke Fever Hospital	38·0	32·07
Meath-street, containing the Cork-street Fever Hospital	52·0	63·8
High-street	7·6	12·2
Peter-street	12·9	10·3
Grand Canal-street	9·3	11·1

During each of the twelve months of each year the deaths by fever were distributed as follows :—January, 55-46 ; February, 41-50 ; March, 49-41 ; April, 45-48 ; May, 36-59 ; June, 45-35 ; July, 28-27 ; August, 24-32 ; September, 27-21 ; October, 27-39 ; November, 41-29 ; December, 57-33. The neighbourhoods in which it was most prevalent in 1865 were those placed in the following order :

North Side—Church-street, Beresford-street, Greek-street, North King-street, Barrack-street, Lower Mecklenburgh-street, Cole's-lane. South Side—Coombe, Skinner's-alley, Meath-street, Patrick-street, West Essex-street, Townsend-street, Poolbeg-street, Wood-quay. And in 1866 : North Side—Church-street, Fisher's-lane, Dispensary-lane, Montgomery-street. South Side—Kilmainham, Marrowbone-lane, New-street, Wood-quay, West Essex-street, Townsend-street, City-quay.

And 3,245 cases, or 127 in every 10,000 of the population, during 1865, and 2,536, or 99 per 10,000, during 1866, were received into the Hardwicke and Cork-street Hospitals from city dwellings. From these hospitals a list of the addresses of each patient admitted during the previous week is forwarded to us on Tuesday, and on Monday night, by the favour of the Registrar-General, we receive the address of every death by zymotic or preventible disease, and those by convulsions which have proved fatal during the previous week. On the following day the houses are visited by the inspector of nuisances or

his assistants. The state of the ashpit, privy, and house-drain is examined, and, if necessary, orders are given to have them put in proper order; the room where the case has arisen is aired, and directed to be whitewashed. If any fresh case has occurred, the address and regulations of the nearest dispensary are given, or the patient is urged to seek admission into hospital, and it is to be regretted that there are not greater powers to compel them. We do not, at present, obtain returns of cases of preventible diseases attended by the fourteen dispensary physicians, but the sanitary sergeants call twice weekly at the dispensary stations, and these gentlemen point out to them any houses which, in their visits, they have observed in an unhealthy state. There are fever-carts attached to Cork-street and Hardwicke Hospitals; but the street cabs must be used for conveyance to other hospitals, which is much to be regretted.

Small-pox caused but 23 deaths in 1866, and in 1865 70 deaths, according to months, as follows:—January, 13; February, 6; March, 10; April, 15; May, 13; June, 5; July, 2; August, 3; September, 1; October, 1; November, 0; December, 1. The parents, or other responsible persons in any house where a case had occurred were urged to bring their children, or all other unvaccinated persons, to the dispensary of the district, the address and regulations being given; and they are informed that they subjected themselves to a penalty for not so doing. Information was also given to the dispensary medical officers of any unvaccinated children.

Scarlatina in 1865 produced 43 deaths, and was most prevalent during August; and in 1866, 63 died from the disease, the greatest number being in September.

Measles, in 1865, caused 157 deaths, and prevailed most during July, August, and September, when 63 occurred. In 1866, 34 persons perished, 13 of them in January. The airing of the rooms and of the bed-clothes and dress was insisted on by our inspectors.

The mortality by diarrhœal diseases I gave you in the lecture on cholera.

Besides the other cleansing and preventive measures before detailed, the flushing of the sewers and surface channels in the poorer streets and lanes was commenced in April, and continued during the dry weather, until October. In most of the streets this was done by a hose from the hydrant; but when the main pipe was too distant, a water-cart had to be employed. In September the water-traps from the street sewers became dry, and had to be occasionally filled from the hydrants. I also publicly advised cold-boiled, and subsequently filtered water, as our present supply is so impure.

The deaths by epidemic cholera, and the means taken to stay it, have been detailed.

Consumption produced 969 deaths in 1865, having been most fatal in the months of January, February, and March. In 1866, 829 were destroyed by it, March, April, and September being the most fatal months. No powers existed to enforce ventilation and prevent overcrowding in workrooms, especially those of the tailoring and dressmaking trades, until this year, and as the state of many of them was such as to promote in a high degree consumptive maladies, they were loudly called for.

Convulsions destroyed the lives of 511 infants in 1865, and of 493 in 1866. As fresh air and sunlight are highly preventive of this and the preceding disease, it is to be hoped that mortality by them will be diminished, when, according to the new bye-laws for tenemental dwellings, the windows will be glazed and movable, and cleanliness and proper sewerage insisted on. The deaths by this disease were nearly one-half less in those neighbourhoods where sewerage and decent house accommodation have been provided for the inhabitants, thus indicating that sanitary efforts have already produced effects.

A most desirable measure is a registration of diseases, especially those which are preventible—namely, the zymotic and tuberculous classes and infantile convulsions. Such is at present carried out by the Manchester and Salford Sanitary Association, and was conducted with the greatest benefit by the Medical Officers of Health in London, until the authorities begrudged the moderate sum the system cost. It might in Ireland be achieved better than perhaps any other European country by our admirably organized Poor Law Medical Staff.

Their ordinary returns would be sufficient (for dispensary physicians have already books enough to keep), if systematically examined. A good map, showing the geological, topographical, and statistical features of the district, would be a valuable addition to every officer's record-book. Information with regard to the location and frequency from fatal disease would be collected. It is guessed that 1 death represents 28 cases of needless illness, but there are no means in force for accurately determining the matter. I have ascertained that the average number of days of bed-sickness which the labourers employed by the Corporation suffer in the year is 6. My friend Dr. M'Cormick, who has for so many years zealously cared for the respectable artizans of the city, tells me that he would make the average somewhat less, In either case, as the number of those who directly or indirectly depend for bread on manual labour is nearly 100,000, it is easy to conceive the misery which results from the temporary illness of the bread-winner. The deaths of the earning members of the families are still more calamitous and lamentable, as at least one-fifth of them are by preventible disease.

The number of sick days to each man in the Metropolitan Police (London) is about $10\frac{1}{2}$ annually, and among working men in the same city about 6. In the police of New York, $16\frac{1}{2}$ days is the average.

The decennial enumeration of diseases gives little in-

formation. Sir D. Corrigan, when examined before the House of Commons, said:

"As evidence how little these returns of disease obtained by the Census Commissioners were to be depended on, he might mention that in all Ireland, on the night of 31st March, 1851, there was not one person returned as labouring under St. Vitus' dance; only 4 were suffering from delirium tremens, only 16 under nervous diseases, only 14 from bronchitis, only 16 from teething, only 60 from hæmorrhoids, only 92 from dyspepsia, only 2 from diabetes, only 4 from scald (though the number in the workhouse hospitals same night was upwards of 2,000)."

The Right Hon. Mr. Justice O'Hagan, in a recent address to the Statistical Society, showed that the registration was not working as satisfactorily as in England. He said:

"As to the deaths in 1864, whilst in England, the proportion of registered deaths to the estimated population, was 2·385, or 1 death amongst 42 persons, and in Scotland the per-centage was 2·382, and the ratio 1 death amongst 42 people; in Ireland the proportion of registered deaths to the population was only 1·652, in the ratio of 1 death to 61 persons. If the same proportion had prevailed in Ireland as in England and Scotland, the number of registries should have been 135,712 instead of 94,075, making the deficiency 41,637, which is equal to 44 per cent. Neither, as to death registration, has there been much improvement in 1865."

The Registration of Births, Deaths, and Marriages Act, 1836, for England, provides a £10 penalty upon undertakers, clergymen, or others concerned in any burial without certificate. This clause, which may have been too harsh to be enforced upon the first introduction of that truly invaluable system into Ireland, might now be adopted. I am strongly of opinion that registration should include still-born children, as a measure likely to check infanticide, and should record the occupation of each person and his residence, when the disease was contracted, as well as at time of death. The English certificate also returns the disease which may have preceded or caused the fatal one; for instance, if an abscess proves fatal after scarlatina, it is useful to know the fact, and the respective duration of the diseases.

The system is different in each of the three parts of the United Kingdom, which is surely anomalous and injurious. The acknowledged failure in obtaining complete returns of deaths in Ireland seems to me to demand that the Registration Act be assimilated to that of England. The relative or other responsible person is the informant, and if the medical man is not satisfied that the death was from natural causes, and in every case of accidental death, he informs the coroner, and thus great aid is given in the detection of crime. The fact also of a certificate as to the actual cause of death being absolutely necessary causes no severe malady to be neglected, which is often the case in this country, despite our admirable system of medical charity. The Medical Registrar has suggested to me that the fittest person in this country on whom to impose the penalty would be the undertaker, as to many rural graveyards there is no sexton attached.

In Paris every death must be certified by the "Medecins des Morts."

The English clerk registrars have returned such causes of deaths, as "worn-out stomach," "want of vitality," "stricture of the windpipe," "morbosity," "hives."

Dr. Lankester's famous calculation that there are 12,000 women in London who had murdered their children, shows that there is great need for alteration in the law relating to concealment of birth and abortion, as also in that directing registration of births, which should be made compulsory in both the case of still-born and living children. It appears, too, that many illegitimate babies also perish from want of proper food and care, and perhaps the giving of over-doses of physic at the hands of those nurses (?) to whom they are delivered.

Dr. Farr has advised the registration of such births, and also a more exact form of certificate of death. This great statist's reports have been so full yet accurate, and

in such forcible and intelligible language, that he has done more service to sanitary reform than any other living man. The Council of Hygiene of New York testify:

"The office and the quarterly reports of the Registrar-General of England, as well as the masterly labours of the medical officer to the Privy Council, have become powerful agencies in working out the most important social and political improvements in that country; and when the effect of all these researches and measures develops itself, it will be seen that even great wars and political earthquakes are really nothing in comparison with these silent social changes."

It is desirable that the certificate as to the cause of death should be sent direct to the registrar, as a certificate stating that a gentleman died of *delirium tremens* might be thrown into the fire by the relatives, or might lead to the dismissal of the medical attendant.

If it be true that in England and Wales more than 50,000 persons perish yearly without any authentic record—scientific or coronatorial—of the diseases and casualties which destroyed them, such is in much greater proportion the case in Ireland.

In the whole of England the deaths of children under one year form over one-sixth of the entire mortality; and in Lancashire nearly one-fifth. Fever and other infectious diseases of childhood produce both in England generally and in London about one-fifth of all these deaths; and convulsions, a malady quite as preventible, one-fifth in England, and only one-seventh in London—a fact which speaks volumes for the working of sanitary measures in the great metropolis, which are as yet neglected in many of the provincial districts and towns.

The mode of feeding children is the most potent cause of infant mortality. In France this was shown lately on a very large scale. Among infants suckled by wet-nurses the mortality was but 37·1 per cent., while it was 63·9 among those who were hand-fed. This and other faulty habits conducive to disease, I have en-

deavoured to decry in preceding lectures, and the efficient remedy lies not in legal restrictions, or even inspections, but in the education of the people in those subjects which promote their physical, social, and consequently moral well-being. This will be apparent from the following list of causes of infant mortality, which are quite independent of the diseases which would appear to be unavoidable during infancy—parents being sickly by intemperance or transmissible disease, errors in feeding, uncleanliness, close undrained dwellings, want of space for open air exercise or play, exposure without sufficient clothing, and quacking, and drugging. The lamentable prevalence of infanticide in England has attracted much attention, and compulsory registration of all births has been advocated. The Harveian Society has further advised that the mothers should not be employed as nurses unless her own child was well-cared for by some other mother. The crime of infanticide in England and Wales is one-third more frequent in proportion to population than in Ireland.

From the last report of the Registrar-General for England it appears that, excluding those from unspecified "zymotic diseases," the greatest number of deaths is from lung diseases, 14 out of 100. Brain diseases caused $\frac{13}{100}$; phthisis, $\frac{11}{100}$; heart disease and dropsy, $\frac{10}{100}$; diarrhœal, $\frac{8}{100}$; typhus, $\frac{6}{100}$; scrofula, $\frac{4}{100}$; stomach and liver disease, $\frac{4}{100}$; violent deaths, $\frac{4}{100}$ among males, and $\frac{3}{100}$ among females.

LECTURE XXII.

THE POOR OF IRELAND—MEDICAL CHARITIES.

Before those direful years, 1845-6-7, when distress perhaps unequalled in the world's history prevailed in Ireland, the potato was the sole support of our agcultural population. Arthur Young (1780) contrasts the English labourer's diet with "the Irishman's potato-bowl placed on the floor, the whole family upon their hams around it, devouring quantities almost incredible; the beggar seating himself to it with a hearty welcome, and the pig taking his share." Probably no other food could have been produced in sufficient quantity to feed the then over-abundant population, at least by the modes of culture then in practice; besides, the extremely subdivided state of the land left the cottier so small a patch, that potatoes alone produced from it could support his family, and daily employment was not to be had by which he could earn money to procure better food. Sir George Nicholls, in his report on the condition of the peasantry in 1836, says: "Land is to them the great necessary of life; there is no hiring of servants; a man cannot obtain his living as a day-labourer; he must get possession of a plot of land to raise potatoes, or starve." A few weeks exertion in planting, digging, and pitting the potatoes would suffice to procure the means of subsistence for the year; and with so little muscular labonr and consequent waste of tissue, so poor a food would support life at this "zero" of comfort. The report of the Devon Commission, 1843, states:

"We noticed with deep regret the state of the cotters and labourers in most parts of the country from the want of certain employment. It would be impossible to describe adequately the privations which they and their families habitually and patiently

endure. It will be seen in the evidence that in many districts their only food is the potato, their only beverage water; that their cabins are seldom a protection against the weather; that a bed or a blanket is a rare luxury, and that nearly in all their pig and manure heap constitute their only property."

By the report of the Census Commissioners we find the loss between 1851 and 1861 to have been 753,418, and emigration is now stated to be proceeding at the rate of 1,300 per week. Owing to this diminution, the increase of employment, and other causes, the cottier system has been supplanted by one in which the peasant earns his support by his daily labour, and for this increase of physical exertion an increase of nitrogenized food is needed.

Another reason why little reliance can be placed on the potato as a national food is, that it has frequently failed, producing in 1739, 1821, 1831-5-6-7-9, 1845-6-7, and every year since, more or less, the most calamitous results. In fact, owing to the humidity of the climate, which seems every year to be increasing, and perhaps some other causes, the soil of Ireland is becoming less suitable for the growth of this tuber. Mr. Coulter, the special correspondent of *Saunders's News-Letter*, informs us that in the parish of Kilnoe, near Scariff, but 200 stones of potatoes were produced per acre in 1864, where 1,500 was an average crop some years back. The potato, too, keeps so badly that it is only available as food for ten months in the year, and the surplus produce of an abundant year cannot be preserved for one of scarcity.

Father Mathew, in a letter printed in the Parliamentary Papers, 1846, says:

"On the 27th July, I passed from Cork to Dublin, and this doomed plant bloomed in all the luxuriance of an abundant harvest. Returning 3rd August, I beheld with sorrow one wide waste of putrefying vegetation. In many places the wretched people were seated on the fences of their gardens wringing their hands and wailing bitterly the destruction that had left them foodless."

Space will will not allow me to attempt a description of the famine years, but I will remind you of the magnitude of the calamity by mentioning that 3,020,712 persons received cooked rations during July, 1847; but Providence having granted an abundant harvest, such relief ceased before October; and that in the supply of food £1,557,212 was expended during the pressure. Besides this, there was expended immense sums in public works, and in staying the progress of famine fever; so about £7,000,000 was expended, nearly half of which was a gift from Government. So great was the influx of the destitute into workhouses that over-crowding and consequent fever became alarming, and in the first four months of 1847, 54 officers died mainly by that contagion. The authorities seem to have recognized the nutritive value of the liguminous plants, for one vessel alone, the U.S. warship *Macedonia*, carried over 11,388 lbs. of peas and 19,424 lbs. of beans.

I have often had occasion to record how greatly the sanitary condition of English and other cities was influenced by its proportion of Irish, but amendment is to be hoped for. In an ably essay by Dr. Shaw, F.T.C.D., it is said:

"The history of an Irish labouring family settling in Liverpool is somewhat of this kind. There is at first a general relaxation of the moral restraints which the public opinion of the neighbourhood imposes on them at home. Increased wages are earned, but from the absence of all artificial wants they are expended merely in animal indulgences. More and better food is used; spirits, tobacco, and beer, are largely consumed; but the home is as filthy and dilapidated as ever. A large proportion, indeed, have sunk irretrievably into profligacy and crime; but against this may be set the equally large number of those who acquire habits of saving along with the means to save, invest their money in trade, take shops, become superintendents in warehouses, and in various ways struggle up into the middle classes of society. The principal step that remains to be taken, is to ameliorate the condition of the Irish labourer, to build a better class of dwellings for them, and some experiments which have been tried in this direction have proved

both remunerative to the capitalists and highly beneficial to the tenants. No agency, however, would be so potent as this, that the habits of the Irish population at home should be raised, and the stream of immigrants constantly flowing into the great cities of the sister kingdom should carry with them a degree of morality and education and refinement of manners, that would prompt them to make a right use of the increased wages earned in their new sphere."

The first Irish Poor Law Act was passed in 1838, and was the production of Mr. Nicholls and G. C. Lewis, then Assistant Poor Law Commissioner, afterwards Chancellor of the Exchequer. It conferred the power of management upon the English Commissioners, an additional Commissioner being appointed; unions and electoral divisions were defined under it, and the election of guardians was regulated. It contained a clause disqualifying any clergyman from filling that office, in which it differs from English Acts, except those governing boroughs. In dispensary committees, where the only objects are the preventive and curative treatment of disease, such disqualification does not exist, for they are the persons best acquainted with the social and sanitary condition of the poor. Resident acting magistrates were appointed *ex-officio* guardians, but it was afterwards enacted that their number was never to exceed that of elected guardians. Officers were to be appointed by the guardians, but were to be removable for certain causes by the Commissioners. The system was at first most unpopular, the collection of rates having been forcibly resisted by mobs in twenty-one unions up to 1844, since when it has gradually increased in general esteem. The Acts which followed relate to amendments of financial matters and administrative details mainly. That passed in 1847 first authorized outdoor relief, and appointed relieving and medical officers to supply it, but the latter are now solely regulated by the Dispensaries Act, 1851. The difficulties of guarding against fraud in the granting of relief is lamentably shown by the report of the Com-

missioners of 1847, wherein it is stated that servants and *employeés* of members of the committees were placed on the list, although many of them were well to do. The general order under which all the duties of officers of workhouses and other matters connected with their government are laid down, is of the fullest character. The rules for the regulation of dispensaries direct that the medical officers shall be fully qualified in medicine, surgery, and midwifery; and that he shall be 23 years of age, a restriction which is much complained of, for many candidates, on having passed all the required examinations, are compelled to wait perhaps idly at home for two years, if they are anxious to be employed in the service.

In the Army and Navy Medical Department, the age is fixed at 21, as well as in most colleges. The midwifery branch of our profession entailed a most harassing amount of duty on officers, but it has been lessened by the appointment of midwives in many instances. Up to 1851, the medical relief of the poor was performed by dispensaries, established under the Act of 1805, in various parts of the country, with ill-defined boundaries; and in places where there was a scanty number of resident gentlemen, no dispensary whatever was often to be found. In 1836, with a population about one-fourth greater than that of 1851, there were but 494 dispensaries in Ireland. The funds were collected from the surrounding inhabitants, an equal sum being added by the grand jury; but they were failing gradually, and the medical officer, if he was to receive anything like adequate payment for his services, should beg it from the residents. So great was the distance from the dispensary to the remote parts of the district, that it was impossible there could be time or frequent attendance; and in 1836, in the county Mayo, which contains 2,100 square miles, there was but one dispensary. There was moreover no inspection to see that the medical attendance and appliances were adequate.

During the three or four disastrous years just preceding, the income almost entirely failed. The new system by which the direction of the medical charities was wholly placed under Poor Law administration was objected to by many, and an amendment, proposing that yearly subscriptions should be also received, met with warm support, and in the Infirmaries Bill of 1854, it was proposed to confer privileges upon subscribers of twenty guineas to the Union Hospitals, into which these institutions were to have been converted.

The medical charities of Ireland were investigated in 1841 by Mr. Phelan and Dr. Corr, and in the same year the first Act to "extend the practice of vaccination," was brought into operation under Poor Law administration. A bill for the regulation of the medical charities was framed, but so powerful was the opposition offered by the medical profession, that it was never brought in. It was not, however, until 1851 that such an Act became law, and the medical treatment of the poor was placed under the direction of the Commissioners (one of whom was to be a medical man), and they were given the power of appointing a sufficient number of medical inspectors, who superintend the medical relief and the working of the Sanitary Act then in force. The funds under this Act are derived wholly from the rates; the guardians were to divide the unions into districts, which were to be governed by a committee of *ex-officio* guardians and elected ratepayers. The medical officers of existing dispensaries were to be continued, and the committees were to have the election of their successors. Regulations for the government of the dispensary system were speedily framed by the Commissioners. The expenditure was estimated at £102,700 for the first year, but that for 1865 was £117,039, exclusive of £13,550 for registration expenses.

Mr. Rumsey, in his great work on State Medicine, objects strongly to the system established in the place of

the voluntary one, mainly because of its pauperizing tendency; but he acknowledges that "the country is much indebted to the medical Commissioner and Inspectors for their arrangements respecting the last cholera epidemic, and for the really philosophical method in which they treat disputed questions as to the origin and propagation of that pestilence."

In arranging the districts, the Boards of Guardians were much influenced by the desire of economy, and the Commissioners in 1854 reported that the average population to each district was 9,060, and the number of acres 28,000. Many districts had 40,000 acres under the care of one medical officer. By the change, the salaries of the officers, which averaged, in 1854, £75, were not increased, although attendance on the sick was made more arduous and the keeping of books much increased.

The construction of the committee, usually elected from unintelligent ratepayers, and their very infrequent meetings, has been often complained of. Many of them, in the more remote parts of the country, cannot read or write, and with a majority the sole leading principle is to lessen expenditure. Such men are incompetent to direct steps for the prevention and cure of disease.

The most galling complaint of the dispensary physician has been the enforced attendance on persons who, though clearly not poor persons, bring tickets from members of the committee. He is bound to attend, but at the next meeting of the committee, which may be many weeks distant, the ticket may be cancelled. Then, however, the attendance has probably ceased, and recovery of due payment cannot be had. It must, however, be allowed that under the old dispensary system the abuse of charitable relief existed to an even greater degree.

Payment from the Consolidated Fund, as medical officers of the army and navy are paid, and superannuation, have been often advocated, and very forcibly by that valuable union of the profession, the Irish Medical Asso-

ciation, and in a pamphlet by Mr. Ellis, when President of the Royal College of Surgeons. Clerks of unions, and such officers, are now superannuated, it being averred that they give their whole time to the duties; but dispensary officers are liable to calls at all times, and in remote districts attendance on the poor forms their whole employment. The Medical Charities Bill, as originally drawn, contained clauses which would have had the effect of absorbing the management of the county infirmaries into the Poor Law system; but being resisted by the surgeons, who, through the grand juries and county members, were able to make themselves heard in Parliament, they did not pass. I have heard, many able and disinterested medical men urge that these infirmaries frequently receive the servants and dependents of the wealthy subscribers, whose treatment on their respective estates should be paid for. The Commissioners were of opinion that arrangements might be made by which artizans, small farmers, and servants might be admitted, on the condition of contributing to their own maintenance. However, by the 25 & 26 Vic., cap. 83, persons suffering from accident or acute disease are admissible into the workhouse infirmaries, and as the county infirmary may be many miles distant, this is an evident advantage. The attempt at amalgamation of the infirmaries failed, owing mainly to the efforts of their surgeons, whose reasons were mainly urged in the *Medical Press*, and in an able pamphlet by one of them, Dr. Little of Sligo.

The fever hospitals of the counties were, however, placed under Poor Law administration, and all must allow that great advantages have followed. In discussing, some years ago, the question whether State provision against sickness promotes or represses pauperism, Lord Stanley paid a handsome tribute to our profession:

"No class of educated men is more hardly worked or scantily rewarded, than are those Medical Officers who devote themselves

to the care of the destitute poor; their claims and grievances deserve, I think, more notice than they have yet received; and, though the power of an Officer of Health, and the exact nature of his functions is a fair subject of dispute, I do not hesitate to say that some such person, charged to detect and make known any gross and perceptible violation of sanitary laws, ought to exist for every part of the country."

From the last report of the Poor Law Commissioners it appears that the greatest number of paupers, namely, 63,009, was in the work-house on February, 25, 1865, and of these, 3,413 were able-bodied males, and 8,522 able-bodied females; and there were then also 12,362 recipients of out-door relief. For the corresponding periods in each of the six preceding years the maximum numbers were—1860, 46,723; 1861, 51,552; 1862, 61,485; 1863, 66,976; 1864, 66,375; 1865, 65,549. The number of fever patients in work-house hospitals on Feb. 11, 1866, was 1,557, somewhat less than on the corresponding day of February, 1865, when it reached 2,211. The total number patients relieved under the Medical Charities Act amounted to 837,669, of which nearly one-fourth were attended at their own homes. Fever was considerably more frequent in 1865 than in 1864, 26,56› having occurred against 21,586, but the visitation which might have been apprehended did not go farther. Epidemics had regularly occurred at decennial intervals between 1816 and 1846, but the periods of 1856 and 1866 have passed without its development, a happy circumstance, which is attributable, without doubt, to the better feeding of the people of late years. The drainage of water supply of Irish towns being unimproved, it is probable that it is typhus, not typhoid, which has diminished, and I must again express regret that a distinction is not made between these diseases, which depend upon, and are supported by such different causes.

Union rating having been established in England in 1865 mainly upon Dr. Hunter's demonstration of its

sanitary advantages, Serjeant Barry advocated the same measure for Ireland last session. In my remarks on the dwellings of the poor, I briefly alluded to the topic. Sir George Nicholls, to whom the establishment of the Poor Law was in great part due, bears strong testimony to the advisability of union rating in his letter in 1853 to Lord Russell, in which also the following noteworthy passage occurs—"With respect to emigration, I think it has been already carried farther than was desirable."

The comparative expense of pauperism in 1856 on each of the populations of the three countries was—Ireland, 2s.; Scotland, 4s.; and England, 5s. 6d; or on each pound of the valuation, Ireland, 1s. 2½d.; Scotland, 1s. 4d.; England, 1s. 5½d.

In England, medical comforts, including food and stimulants, are issued as part of the dispensary relief, but in Ireland the practice was not legalized by the Acts.

In their circular of Aug. 23, 1865, the Commissioners justly state that the powers for preserving the public health "have ceased in many parts of the country to be exercised with sufficient vigilance and activity."

In my Fifteenth Lecture I detailed to you the sanitary state of many of our towns, which, uncontrolled by any central authority, were disgraceful. I do not think that they will be improved until they are regulated by some body analogous to the English Local Government Office, and if the Poor Law Commissioners would undertake the supervision of all local authorities, those that are Town Commissioners, as well as those that are Boards of Guardians, a positive and rapid improvement would follow.

The Committee of the House of Commons, which investigated the working of the Dublin hospitals, say—

"A medical school of the highest repute has been established in Dublin, which is almost entirely dependent on the indirect mode of support by Parliamentary Grant to these hospitals. The system

of instruction pursued appears to possess many advantages. Sir Benjamin Brodie has stated in his evidence, that its continuance is, 'as a national object,' very important. The most eminent physicians and surgeons in Dublin devote a great portion of their time to instruction and hospital attendance. Separate schools are attached to the different hospitals, which has the salutary effect of creating emulation. Museums, founded at great expense, and admirably adapted for their purpose, exist. Except in a very few cases, the salaries of the medical officers are not derived from the funds of the institutions. Their emoluments arise from pupils fees. This system, thus nearly self-supporting, has hitherto been most successful. Ireland has been furnished from Dublin, even in its remote districts, with medical men of sound education. 968 dispensaries have now to be supplied with properly-qualified attendants: the withdrawal of these hospital grants would, in the opinion of your Committee, occasion the ruin of this great educational system; and at a time when Parliament has shown so munificent a disposition towards the diffusion of knowledge, and the encouragement of science and art, your Committee hope that it will not hesitate to provide an adequate sum for the development of that science which is most beneficial to mankind."

I think I have elsewhere referred to the half-time system, but the remarks of the Poor Law Commissioners on this subject, expressed in a circular to their inspectors in 1853, are so convincing, that you should hear them.

"It has been observed that where the school hours have been limited, and the children employed in the open air, they have assumed a stronger and healthier appearance, whilst they have not fallen back in other branches of knowledge. The Commissioners believe it to be of the utmost importance that children who have to live by their labour should be trained to labour early. A boy who has not handled a spade at the age of fourteen will rarely turn out an active labourer, and that it is therefore most desirable that the boys generally should be accustomed to work at the earliest practicable age. It has been observed that the success of all benevolent institutions for the education of the children of the poor, at home and on the Continent, has in no small degree turned on the amount of industrial teaching provided for the children, and that those institutions have been less useful where the chief efforts have been directed to literary attainments. The guardians should, of course, provide the necessary agricultural implements suited to the age and strength of the children."

Agricultural employment for the adults is also most advisable, and it was the intention and is the desire of the authorities that these institutions should be, as their name implies, workhouses. With regard to the evils of confinement, Dr. Guy expresses too forcible an opinion: "It is highly probable that for every life which the Poor Laws save by averting starvation, a hundred are sacrificed by the imprisonment they inflict." Despite every sanitary advantage, the monotony and confinement in prisons keeps up a high death-rate. The condition of the London workhouses created a vast deal of public interest last year. The *Lancet*, and that most admirable journal, the *Pall Mall Gazette*, astonished the public by revelations as to their management, and Mr. Farnall and Dr. E. Smith, the Inspectors appointed by the Board, acknowledged that there was very great need for reform. Dr. Smith's statement that wards in a workhouse which allow 500 cubic feet to each inmate might be well ventilated, excited much animadversion, but it must be remembered that in London slums (and in Dublin ones too, as I have mentioned) not one half that amount is available. Deficiency of light, and want of water on Mondays, are notable defects, and Dr. Smith advises "a re-arrangement of the mode in which the medical officer performs his duty is necessary, with a view to the devotion of more time to them. The medical officers should act more generally as sanitary officers, and their recommendations of every kind should be in writing." With regard to the deficiency of inspection, he says: "More than one Inspector of the Poor Law Board should be appointed for the district, and after the example of the Lunacy Commissioners, they should have special and different professional qualifications." According to this recommendations the Board secured the services of so distinguished as sanitarian and physician as Dr. Markham, of St. Mary's Hospital.

The following statement, signed by the leaders of our profession who joined the Association for the Improvement of the Infirmaries of Workhouses, indicate the principles which were sought for in regulating these institutions.

"Having been requested to express our opinion of the principles which should guide any efforts to improve the State treatment of the Sick Poor in Workhouse Infirmaries, we beg to state that any scheme, in order to be satisfactory, should, in our judgment, be based upon the following principles:—

"1. The sick poor should be separated from the able-bodied paupers, and their treatment should be placed under a distinct management.

"2. In lieu of sick wards annexed to each workhouse, consolidated infirmities should be provided, where the following rules of hospital management should be adopted, under skilled supervision. They are those generally accepted in this and other European countries.

"I. The buildings should be specially devised for the purpose; of suitable construction, and on healthy sites. The rules laid down by the Barrack and Hospital Commission may be consulted with advantage on this subject.

"II. Not less than 1000 (and for particular classes of cases 1200 to 1500) cubic feet of air should be allowed to each patient.

"III. The nursing should be conducted entirely by a paid staff, and there should be not less than one day nurse, one night nurse, and one assistant nurse for each fifty patients.

"IV. There should be resident medical officers in the proportion of not less than one for each 250 patients.

"V. The medical officers should not have any pecuniary interest whatever in the medicines supplied, nor should they be charged with the duty of dispensing them.

"VI. A judicious classification of patients should be strictly observed; the epileptic and imbecile, the acutely sick, and the aged and infirm, being treated in separate wards.

"VII. The aged and infirm, the chronically sick, and the convalescent, should be provided with day rooms separate from the dormitories.

Signed, THOMAS WATSON, M.D., Bart., Pres. Coll. Phys
GEO. BURROWS, M.D., Pres. Gen. Med. Council.
JAMES CLARK, M.D., Bart. (Phys. to Her Majesty.)
WM. JENNER, M.D. (Phys. to Her Majesty).
E. SIEVEKING, M.D. (Phys. to Prince of Wales).
WM. FERGUSON, Bart. (Surgeon to Her Majesty).
JAMES PAGET, (Surgeon to Her Majesty)."

LECTURE XXIII.

SANITARY ORGANIZATION.

TIME will not permit me to give you anything like a history of sanitary measures, but a few allusions to the subject may interest you. So ancient a philosopher as Plato advocated the provision of State physicians (*εντεπολὲι ιατρωνς*), who had profoundly studied the laws of health and disease. In the beginning of this course I told you something of the sanitary works of ancient Rome, their neglect in the middle ages, and the resulting frequency of plagues. In England some attention was paid to the subject at an early date, for we are told that Henry VI. sent commissioners of sewers into all parts of the realm, to inquire into the state of the "walls, ditches, banks, gutters, sewers, gotes, calcies, bridges, streams, and other defences by the coast of the sea and marsh ground," which were to be "corrected, repaired, and amended." Henry VIII. extended this commission over twenty years, the commissioners taking oath that they would execute the ordinances according to their "cunning, wit, and power, without favour, meed, dread, malice, or affection," and his successor rendered this commission permanent. Among writers of the eighteenth century, none urged sanitary recommendations more forcibly than did the immortal Linnæus in his "Dissertation on Habitable Air." Very little of a comprehensive nature was done except within the last thirty years, and the present was indeed the reign of sanitary legislation.

I freely acknowledge that within the last few years a great deal of attention on the part of the public, even from the very highest, has been given to the subject of public health, and the truth of Benjamin Franklin's opinion, that "public health is public wealth," is gene-

rally felt. The first public act of our gracious Sovereign, since her bereavement, was to open last November the Aberdeen Water-works, and on the occasion her Majesty said:

"I have felt that at a time when the attention of the country has been so anxiously directed to the state of public health, it was right that I should make an exertion to testify my sense of the importance of a work so well calculated as this to promote the health and comfort or your ancient city."

The Rev. Dr. Haughton has enumerated, among the views which guide people about the management of cholera, the "Will of God theory," by which maladies clearly dependent on man's neglect are supposed to be unavoidable. Buckle quotes Lord Palmerston's answer to those who begged him to procure the appointment of a public fast in view of approaching cholera:

"The best course which the people of this country can pursue to deserve that the further progress of the cholera should be stayed, will be to employ the interval that will elapse between the present time, and the beginning of next spring, in planning and executing measures by which those portions of their towns and cities which are inhabited by the poorest classes, and which, from the nature of things, must most need purification and improvement, may be freed from those causes and sources of contagion, which if allowed to remain, will probably breed pestilence and be fruitful in death in spite of the prayers and fastings of a united but inactive people."

I may mention that Dr. Klob of Vienna has found myriads of fungi in the cholera discharges.

Dr. Jenner, the Queen's Physician, in an able address which he gave as president of the Epidemiological Society, proved a large part of the diseases which are looked on as inevitable to be really the result of ignorance of the laws of health in the present or past generations, and boldly asserted that an enormous mortality was due "to the neglect of their duties by the wealthy who know and obey laws, but fail to give the poor the means of obeying them, to the *inertia* of the Legislature, its unwillingness to interfere with individual action, its fear of touching vested interests, its dread

of offending religious prejudices, though they may be the offspring of ignorance."

Notwithstanding all the lamentable evidence which the Council of Hygiene in New York has brought forward of the death-dealing state of the purlieus of that city, the municipal inspector reported the year previously that "this talk about the number of lives that are lost each year for want of proper sanitary measures is a perfect fallacy." In one house, fever had prevailed without intermission for four months, and six deaths by that disease had occurred, besides some sent to the fever hospital, yet no step whatever had been taken by the health officers. In many instances several large houses had only one communication with the main sewer, their house-drains joining so as to save expense in breaking the street. This has led to bad results, for a stoppage near the opening must render useless all the drains.

The responsibility of sanitary authorities will not remain much longer unquestioned, for the Warwickshire coroner has notified that he will hold inquests on deaths by cholera, as "criminal culpability may attach;" and a gentleman in Louisville, U.S., has sued the corporation for 25,000 dollars damages, his wife and daughter having died, he alleges, through their neglect in draining the street in which he resides. Dr. Farr says:

"The precise degree of influence which the various agencies have in causing the high mortality of towns, is not easily determined. Opinions differ as to what fraction of the suffering and death is to be set down to the want of water or of sewerage, crowded lodgings, narrow streets, ill-ventilated workshops, the destitution of skilful medical advice, the neglect of children, doses of opium and overflowings of quackery, slaughter-houses, and rank churchyards."

At a meeting the Metropolitan Sanitary Association in September last, the Bishop of London in the chair, the Medical Officers of Health, through their President, Dr. Druitt, suggested that the subscriptions in relief of the sufferers from cholera should be expended in procuring a

good supply of water, and possibly of milk at reasonable prices, and the erection of baths and workhouses in the east of London, where these necessary means of health were sadly deficient, as, indeed, the prevalence of cholera proved. The Jews, in Whitechapel, had erected thirty stand pipes, with great advantage. Dr. Farr, F.R.S., regarded

"Any resolution emanating from Dr. Druitt with the greatest respect, representing as he did a body of men who were second to none in their knowledge of the particular subject under consideration. His proposition was by no means incompatible with the recommendation that an appeal should be made to the Government for a royal commission of inquiry, which must be prospective."

The motion was, however, withdrawn, Mr. Godwin, F.R.S., editor of the *Builder*, having proposed, and the majority of those present having agreed to a resolution, calling on the Government to appoint a royal commission to inquire into the sanitary state of the metropolis. Mr. Godwin said:

"Until public opinion was formed—till knowledge on sanitary subjects was more general—what improvement could they expect? What must they look for, when in the present day they heard from a town near Leeds the pretensions of a person to become a member of the local board grounded on such reasons as these—that he would oppose all schemes for levying rates for the supply of water; every measure to obtain public sewerage or the paving of streets; every measure of that sort, in fact without exception, on the principle that all such things were a wasteful expenditure of the ratepayers' money? When they saw a placard like that; when they found doctors themselves expressing opinions contrary to one another and to all that had been proved by experiment for many years—why, they had educated men saying that bad drainage did not produce disease. He had in his pocket a letter from a ratepayer in Sheffield stating that assertions made at the late meetings of the British Association had entirely paralysed the efforts of those among the people of Sheffield who desired to obtain proper drainage. Those present must have read on the previous day of an accident in a tank in Ireland (Swords), where four men descended one after another to clear away decomposing matter, and each one fell dead as he reached the bad air; and yet they still found men doubting if the emanations from sewers produced disease."

In 1818 an Act was passed legalizing the appointment of health boards, with most extensive powers; but the Royal Commissioners on the State of Ireland, in 1836, reported that this provision had been rarely acted on.

The Metropolitan Sanitary Commission reported in 1848:

"That on examination of the actual state of the back streets, lanes, courts, and alleys of the metropolis, it is found that in general little or no improvement has taken place in their sanitary condition since the prevalence of cholera in 1832, and that were this disease again to break out in the present state of these localities, there is no reasonable ground to suppose that the pestilence would not spread as extensively and prove as fatal as on its former visitation."

Whenever the death-rate of an English town exceeds 23 per 1,000, or when one-tenth of the inhabitants petition the Privy Council, a thorough inspection of its sanitory state is at once conducted, and improvement immediately follows. I could mention many Irish towns in which the death-rate is one-fourth higher, and in which such palpable causes of disease as surface channels instead of sewers, scanty and foul drinking-water, and over-crowded and loathsome graveyards exist, and yet are the inhabitants either ignorant or negligent of their danger, and the local authority, which should care for the health of the town, utterly apathetic.

The great disadvantage of the present Sanitary Acts is, that they do not consolidate the authorities for their execution, nor are their clauses consistent with each other. Under the recent Act, the Privy Council may call upon two neighbouring boards of guardians to unite for the purposes of the Disease Prevention Act, but not for any permanent object.

Since 1852, the Poor Law Commissioners, to whom is entrusted the sanitary control of all the country, except corporate and commissioned towns, have frequently circulated in every union the following lamentable facts:

"Typhus fever has long been the scourge of Ireland, attributable in a great measure, no doubt, to causes not removable by the guardians, but also to a very great extent the result of the undrained filthy state of the worst parts of almost every Irish town, unknown and unvisited by those in better circumstances; but when once fever is prevalent, it extends its ravages to all classes, and is even more fatal to the rich than to the poor. It may at the same time be observed that any precautions of the kind herein adverted to, which tend to diminish the prevalence or virulence of epidemic or contagious disease amongst the poor, will no doubt tend also to the saving of the rates, by diminishing the demands for relief at the cost of the rates."

I regret I must report that little amelioration has yet ensued; the remedy seems to be, the regulation of these towns, containing 2,000,000 people, as well as the Poor Law districts, by these Commissioners, or some central authority. In Mullingar, which has been always noted for the prevalence of preventible disease, a meeting was called last November to take steps for the sewerage of the town. The expense was estimated at £3,000, one-third of which the lord of the soil, Col. Greville Nugent, M.P., offered to give. The ratepayers, almost unanimously, decided against improvement. In less than a month cholera was raging fearfully among them. At a meeting of the Statistical Society, a year since, Mr. Conn, P.L.G. of Waterford, noticed the case of a town in his neighbourhood, in which there was the most lamentable need of sanitary improvement, yet none had been effected, as the proprietor of the town (which numbered 800 houses) had expressed himself content; and as the ratepayers had no leases, they were by this hint most effectually silenced, and breathed their malaria contentedly. He advocated the appointment of professional men to examine and report to a central authority on the sanitary wants of localities throughout the country, and contended that local proprietors should be compelled to do their duty in preserving public health.

The local inspectors of the small Scotch towns would

seem to be inefficient conservators of the public health, if the following instance, just recorded in the *Medical Press*, is illustrative. The inspector constantly reported in flattering terms the state of a town. The Board of Health, however, requested a higher sanitary authority to examine into it. The "inspector's own premises were found to be in a most unsatisfactory condition," and forty cart-loads of filth were taken from the partly open stream in one of the streets which formed the sewer of the village. The town was improved; one man who carried the cholera into it died. There was no other case; but the son of this man. who came to visit him from a distant village, returned to die there, and to originate an epidemic which caused some hundreds of deaths.

But one enemy of life is being repulsed in Scotland. The new Vaccination Act is working well, for the Registrar of Bridgeton, a district containing nearly 50,000, notes that in 1863 he had 31 deaths from small-pox, and in 1864, 23; but the Act having got thoroughly into operation, in the whole of 1865 this disease was fatal in one instance only, and in the first quarter of 1866 in not one.

I will now explain to you the system which is organized in Dublin, and that pursued in England, in order that you may see if they be worthy of imitation in Belfast, Cork, Limerick, Waterford, Galway, or other cities where nothing analogous exists.

The appointment of a Medical Officer of Health is under the 12th section of the Towns' Improvement Clauses Act (10 and 11 Vic., cap. 34), and the duties in it are described as follows:

"To ascertain the existence of diseases within the limits of the Special Act, especially epidemics and contagious diseases, and to point out any nuisances or other local causes likely to cause and continue such diseases, or otherwise injure the health of the inhabitants, and to point out the best means for checking or preventing the spread of such diseases, within the limits aforesaid, and

also the best means for the ventilation of churches, chapels, schools, registered lodging-houses, and other public buildings within the limits aforesaid, and from time to time, as required by the Commissioners (*i.e.* Corporation), to report to them upon the matters aforesaid, and to perform any other duties of a like nature which may be required of him."

Dublin and Derry have appointed medical officers of Health. In the latter city Dr. Wm. Browne, F.R.C.S., has held the post for many years with great credit. In this City, as you are aware, the death returns are published on Wednesdays, and I have, as Medical Officer of Health, the advantage of receiving, the previous Monday, the address of every death by preventible disease, in order that the sanitary inspectors may discover and remove the causes which led to its occurrence. I do trust somewhat confidently that good will result from the harmonious working of the registration and sanitary systems, and I, for my part, will look on the weekly return as my pressure gauge, for it will stimulate our efforts to diminish the removable causes of disease if it tells of increasing deaths by preventible maladies ; or if they be decreasing, we will endeavour to ascertain the circumstances which have led to so favourable a result. The Registrar General's facts, when popularized and compared with each other, are the truest means of making the ignorant or apathetic perceive the value of sanitary reform.

I will next detail very briefly the means which the city now possesses for preventing the occurrence of disease. A complaint-book lies at the City Hall, and in it can be entered notices of any nuisance which has been observed within the city boundary. The inspector of nuisances then visits the locality, gives instruction for its removal, and enters a description of it on the opposite page of the complaint-book. The more remarkable, or those in which a professional opinion seems needed, are specially reported to me, and I give instructions as to the proper means for removing them or abating their injurious effects. Lists are received weekly from the regis-

trars of the fever hospitals of the residences from which patients are taken, and all such houses are visited by the inspector or his assistants, and ventilation, lime-whiting, and cleansing of them is insisted on. The eight sanitary sergeants of the metropolitan police report weekly to the Sanitary Committee of the Corporation all nuisances they have discovered, and the means taken for their suppression. All sewer-traps and gullies are kept constantly under inspection, and repaired when necessary, and cesspools are suppressed when possible. Means are being taken to compel the proprietors of over 100 factories to consume the smoke of their chimneys, which is productive of much nuisance and inconvenience to those living near them. Endeavours will be made to remove all lime-kilns from the city, but it is especially in the country they should be suitably protected, for over thirty lives are annually lost owing to the poor wretches who sleep by them being burned or poisoned by carbonic acid. If arrangements were made for the recompense of dispensary physicians, lists of all cases of zymotic disease might be received from the dispensary stations in the city; and the able officers of these institutions, by forms supplied them, would be able to bring under the sanitary department all causes which, if unchecked, might propagate disease. I report every Friday to the Sanitary Committee all deaths by preventible diseases which have occurred for the preceding days, with remarks on the sanitary state of the city, and the means adopted for improving it; and the committee make a monthly summary of these statements public, as they hoped that benefit might thereby arise.

Among the occasional duties of the committee will be endeavours to suppress any epidemics which may invade the city; and I am convinced that this sanitary organization, by urging vaccination, examining water-supply and drainage, and the removal of the poor to hospital—when small-pox, cholera, or typhus prevails epidemi-

cally—saves many lives. From the public we can get most efficient aid, and if the benevolent, whose mission of charity or religion brings them to the dwellings of the poor, will inform the sanitary officers at the City Hall of any comfort and health-destroying nuisances they may observe, they will render their house-to-house visitation still more valuable. By an Act just passed, all humble houses set in tenements may be inspected, and the owners of them compelled to keep them in a habitable and wholesome state, according to the bye-laws which, as I told you, were framed by the committee with which it is my privilege to be connected.

The City Analyst gives most efficient aid as chemical referee on the various questions which arise, and the duties of that office, as set forth in the 23 and 24 Vic., cap. 84, include the microscopical examination and chemical analysis of all articles of food or drink purchased in the city, which may be presented to him, for a fee which the Corporation has fixed at two shillings and sixpence.

The Inspector of Nuisances occupies himself daily from ten to four in visiting the different localities and premises within the district where nuisances exist, or are likely to exist, observing and taking note, in writing, of their sanitary condition, forwarding measures for their prevention and removal, and using the greatest promptitude in the discharge of such duty; in visiting the bake-houses, so that all may be inspected and reported on at least once every two months; in inspecting every nuisance complained of, on the day upon which such complaint is made, and, if well-founded, to have same abated without delay.

If there are assistants, he should receive their reports every day in writing, and frequently, by personal inspection, to test their accuracy.

When summonses are necessary, he should see that the same are correctly served, and attend court to watch the cases and give evidence.

He should have his own and assistants' work marked out for each day the evening previous, so that all may be at work not later than ten o'clock A.M.

There are also eight sergeants of the Metropolitan Police, four of whom receive their pay from corporate funds, and during the past year they have paid 23,539 visits to houses set in tenements, procured the remedy of 32,201 defects without prosecution, and obtained 327 convictions, no summons having been dismissed. Seven houses were closed as unfit for human habitation. The sergeants also visited nightly lodging-houses on 1,171 occasions; slaughter-houses, on 1,646; and bake-houses, 575 times.

The complaint-book is open daily at the City Hall from ten to four, and entries of such complaints as want of sewers, filthy cesspools and privies, the emission of smoke, the keeping of pigs, &c., are made by me, by dispensary or other physicians, the police sergeants, householders, or other persons aggrieved. Anonymous letters are also received and attended to. Many complaints come for frivolous and vexatious reasons, and much time of the inspectors is occupied with cases in the houses of those who could well afford to pay for the remedy of their grievances. The entries have been 304 during the year 1865, and 473 in 1866, numbers respectively more than three times as numerous as any former year, and which indicates the increased activity of the Sanitary Department. The inspectors visited 4,037 premises complained of, or in which fever had been discovered, during 1865, and 3,219 during 1866.

Swine have been removed from many localities by the magistrates' order, on my certificate that their being kept was a nuisance injurious to health.

Until the Sanitary Act became law there were under the old Nuisances Acts many examples of the partly unavoidable tardiness in the removal of nuisances, but with the prompt aid of the divisional justices little delay

is now experienced. I have not met with the unwillingness to act in sanitary cases which is assigned to magistrates elsewhere, notwithstanding the press of business at certain hours in our police courts. I think, however, that a committee of the sanitary authority of at least the larger towns, consisting of magistrates, or gentlemen of similar position, might be entrusted with jurisdiction directly in such cases. A few years ago a sanitary court sat under the presidency of Sir E. Borough, with the greatest public advantage; and a memorial has been presented to His Excellency praying that the present vacancy among the Divisional Magistrates may be filled with the object of one devoting his time to the sanitary and municipal cases. I believe, therefore, that the sanitary state of Dublin will contrast favourably with that of any other city in the United Kingdom, when pure water shall be supplied to every house, when sewers are extended, and a few other improvements effected without increased taxation—a subject on which our citizens are just now rather sensitive. It is, however, vastly more healthy than 100 years ago, when Dr. Rutty described it, with apparent truthfulness, as the most unwholesome and worst regulated town in Europe. Alcohol lent its aid, for he reckoned that nearly one-third the houses were then ale-houses or spirit shops.

The Rev. Charles Kingsley, an earnest and most eloquent advocate of sanitary reform, says:

"I see no good reason why the right of inspection and the power of control should not be extended to all dwellings whatever, with whatever precaution that may be thought necessary to guard against the risk, if risk there be, of intrusion upon domestic privacy, which appears to me a very shadowy danger. Simple inspection, with publication of the results, by officers not locally connected, will do much to bring about the remedy, which local authorities have the power, but not the will, to apply. Why a permanent staff of Government sanitary inspectors should not be appointed it is difficult to say. We have now factory inspectors, mine inspectors, school inspectors, and they all work well. Not an argument can be brought against the institution of sanitary inspectors which was not brought against them."

I may add, that for one person who is killed or injured by factory machinery, or by any other danger of the system, perhaps a hundred perish or pine from the provocatives of disease which are not sufficiently apprehended by the authorities.

The greatest advantages arise from sanitary surveys of cities. In New York the twenty-nine voluntary health officers have ascertained the existence or non-existence of sewers in every part of their districts, the position of slaughter-houses, piggeries, and of all factories where noxious trades are carried on, and the number of cases of fever which, during the previous year, had occurred in each house. It was proved by the leading physicians who formed the corps, that in some districts the death-rate was twice as great, and the sickness-rate ten times as great in others. These particulars, as well as the geological features, and all other sanitary circumstances, they have had marked down on a large map constructed for that purpose, and the value of such a reliable record can be easily conceived. Professor Gairdner, the medical officer of Glasgow, has adopted a similar plan for that city, and I propose to do so as soon as the new map of the city, on the scale of five feet to the mile, is published. The surveys for the purpose have been completed.

I shall here mention that few countries possess so accurate and comprehensive maps as Ireland, and the Ordnance Survey is one of the benefits which in this country we owe to the ability and energy of Sir Thomas Larcom, and he it was who mainly advocated the Geological Survey of Ireland.

I will next endeavour to describe the sanitary organization in England, and the amendments of it recently proposed by authorities whose own words I shall quote. The Local Government Office and Medical Department of the Privy Council in London may be regarded as the great central public health authority. When one-tenth of the inhabitants of any town petition the Home Secre-

tary, or when the death-rate rises to 23 per 1,000, an inspector competent to examine its water-supply, sewerage, and other sanitary circumstances, and to investigate the manner in which the Lodging-house, Nuisances, and other Sanitary Acts are carried out, is despatched to it. The appropriate remedies are urged upon the local authority, and every aid in the way of loans, suggested bye-laws, instruction and supervision is given by the central office. Although, therefore, the Public Health Act (1848) and the Local Government Act (1858) are, like our Towns Improvement Act, permissive, many hundreds of towns and populous places have been by proper representations induced to adopt their admirable provisions. While a town of 200 inhabitants in England and 700 in Scotland may adopt the Health Act for works of improvement, none except those of 1,500 can take advantage of the similar measure in Ireland.

These Acts, which have lowered the annual mortality of the towns in England by 6 per 1,000, were prepared by such statesmen as Lord Morpeth, Sir G. C. Lewis, and Sir George Grey; and although it was declared that they should not extend to Ireland, the lamented nobleman I have named, who was then Commissioner of Woods and Forests, expressed a hope that the Public Health Act would afterwards be granted for this country. The medical officer of the Privy Council under the Public Health Act, Mr. Simon, according to his yearly reports, besides the above routine duties, has conducted personally, or through assistants, many vitally important investigations throughout England, as those into the causes of infant mortality, the working of the vaccination laws, the food supply, and house accommodation of the labouring classes, the parasitic and other diseases of cattle in relation to the supply of meat and milk, the peculiar diseases of various industrial classes, accidental and criminal poisoning, the prevalence of fever, diarrhœa, diphtheria, and other epidemics. By his officers he also

inquires into local outbreaks of disease—for instance, 31 places were so inquired into in 1863. The prevalence of eye-diseases, of certain forms of skin-diseases, and of convulsions among the children of the poor, the health of miners, and of linen and muslin workers in Ulster, the dwellings of the agricultural labourers, and the state of burial grounds, to which I before alluded, are subjects of equal importance which in this country have never been approached. Unless the thirty towns described a few lectures back be exceptional, sewerage, water-supply, and the carrying out of the Sanitary Acts seem to call for systematic and scientific inquiry. Since the last cholera epidemic, the Poor Law Inspectors cannot be said to have been engaged in any investigations similar to those conducted by the medical officer of the Privy Council. Those which were directed to the alleged destitution last year cannot be regarded in such a light, as they did not concern the management of towns, sewage, water-supply, lodging-houses, nuisances, state of burial-grounds, &c., and indeed they were declared by the Commissioners "somewhat out of the limits of the official business of the department." Thus, while we have for our poor the best organized system of curative medicine in the world, the same cannot be said of our arrangements for prevention.

The duties of health officers are so well described in the instructional minute issued by the late General Board of Health, that I shall quote it almost entire:

I. The officer of health is appointed—first, in order that through him the local sanitary authority may be duly informed of such influences as are acting against the healthiness of the population of his district, and of such steps as medical science can advise for their removal; secondly, to execute such special functions as may devolve upon him by the statute under which he is appointed; and, thirdly, to contribute to that general stock of knowledge with regard to the sanitary condition of the people and to the preventible causes of sickness and mortality which, when collected, methodized, and reported to parliament by the general board of health, may guide the legislature in the extension and amendment of sanitary law.

"II. The duties of officer of health will be to the following effect:

"He will make himself familiar with the natural and acquired features of the place, with the social and previous sanitary state of its population, and with all its existing provisions for health; viz., with the levels, inclinations, soil, wells, and water-springs of the district; with its meteorological peculiarities; with the distribution of its buildings and open spaces, paved or unpaved, of its burial-grounds and lay-stalls; with the plan of its drains, sewers, and water-supply; with the nature of its manufacturing and other industrial establishments; with the house-accommodation of the poorer classes, and the facilities afforded them for bathing and washing; with the arrangements for burial of the dead; and with the regulations in force for lodging-houses and slaughtering places, for the cleansing of public ways and markets, and for the removal of domestic refuse. And, if he be the first officer of health appointed in his district, he will, without unnecessary delay, furnish to the local board a connected account of these matters, so far as they relate to the public health, making thereon such practical suggestions as he may think applicable.

"III. For the proper performance of these duties, special qualifications in science are required. These lie in pathology, including vital statistics, and in chemistry with natural philosophy:

"In *pathology*, because this science implies an exact study of the causes of disease in their relation to the living body—a study of what they are, and how the act, and why they seem to vary in operation:

"In *vital statistics* (properly a section of pathology) because, by analyzing the composition of various death-rates, and by learning how the pressure of particular diseases differs under different circumstances of climate, season, dwelling, age, sex, and occupation, definite standards of comparison are gained, without which the officer of health could not estimate the healthiness or unhealthiness of the population under his charge:

"In *chemistry* (including the power of microscopical observation) because without such aid there can be no accurate judgment as to impurities of air and water, dangerous impregnations of soil, or poisonous admixtures in food; and because the same science also guides the application of deodorizing and disinfectant agents:

"In *natural philosophy*, because many nuisances are traced, and many questions as to ventilation and over-crowding are answered by its laws; further, because by its aid the officer of health studies the atmospheric changes, and learns the climate of his district—important steps in proceeding to speak of its diseases; and finally, because natural philosophy, in conjunction with chemistry, renders

him competent to report on many manufacturing processes alleged to be hurtful to health, and on the sufficiency of such means as are employed to reduce the evils ascribed to them.

"The branches of knowledge here spoken of are parts of every extended medical education—for curative and preventive medicine are founded on a common basis; but they are not the parts which have most direct relation to the treatment of disease. The most distinguished practitioner of a neighbourhood may, indeed, happen to be also the person best qualified for a sanitary appointment; but the reverse must often be the case, for not all members of the medical profession can afford equal leisure to cultivate those distinctive studies; and it will imply no disparagement of men actively and skilfully engaged in the treatment of disease, if the special qualifications in question should sometimes be found in other members of their profession rather than in them.

"IV. *Other avocations desirable.*—The occupation of an officer of health will not usually be inconsistent with his devoting a portion of his time to certain other professional engagements; but, where possible, it will be well to debar him from the private practice of his profession—first, because the claims of such practice would be constantly adverse to those of his public appointment, the duties of which (especially at times of epidemic diseases, when his official activity would be most needed) private practice could scarcely fail to interrupt and embarrass; secondly, because the personal relations of private practice might render it difficult for him to fulfil with impartiality his frequent functions of complainant; and thirdly, because, with a view to the cordial goodwill and co-operation of his medical brethren, it is of paramount importance that the officer of health should not be their rival in practice, and that his opportunities of admonitory intercourse with sick families should not even be liable to abuse for the purposes of professional competition.

"Objections of this nature will not generally hold against the officer of health being professionally connected with the medical school or hospital of his town. Provided such engagements are not of too engrossing an amount, it will conduce to the efficiency and public estimation of an officer of health that he be thus kept conversant with the practical aspects of his profession, and have given some security for keeping pace with its scientific progress."

Dr. Farr has proposed that in every registration district a medical officer shall be appointed who shall examine every body which has died without medical attendance, and ascertain if the death be free from

suspicion; if not to order an inquest. He says the following advantages would accrue:

"1. The cause of death would in all cases be certified by one professional witness, and would be recorded as correctly as is practicable in the present state of science. 2. The fact that a given person died at a given place would be attested by the informant as at present, and the evidence would be enormously strengthened by an educated witness. While so large a portion of our informants cannot even write their names, this is of great importance. 3. Secret murders, and attempts on life, and deaths of children and old people from neglect, would rarely escape detection; they would, other things being equal, be less frequent than they have been in past times. Life would become more secure; the public solicitude, like a providence watching over all, would cherish the reverence of all classes for human life. 4. The frauds of informants would be less common, and no registrar would again manufacture fictitious entries, thereby throwing discredit on the whole of the national registers. 5. Much trouble would be saved to the public, who are now put to expense in getting corroborative certificates, as it is felt that the present certified copy of an entry is most imperfect evidence of the death and identity of deceased persons. 6. The registration medical officer, visiting the dwellings of people in unfavorable sanitary condition, would discover and point out the consequences of those conditions to the families themselves and to the authorities in seasons of cholera, of fever, or other epidemics. The authorities would find it convenient to make him the health officer of the district, and often where such an officer already exists he might discharge the medical registration duties. The Postmaster-General would employ the registration medical officer in insurance business, and so would insurance offices, to whom he could render essential service in putting a stop to the numerous frauds which are every day committed at their expense."

Mr. Rumsey, after closely analysing the sanitary systems of various European states, advised, last August,

"That in addition to the ordinary professional qualifications required by the Medical Act, evidence of special qualifications and of adequate experience be demanded of all candidates for the appointment of health officer; and that, *after a future date to be fixed in the Act*, no appointment be valid without a certificate from some *examining board*—to be constituted or recognised for this purpose—that the candidate is duly and specially qualified for the office. That officers of health be protected in the exercise of their

functions, by repealing all enactments which empower local boards to dismiss them, and by vesting the power of removal in the central authority. That officers of health be legally authorized to procure all necessary information from medical officers of Poor Law districts, workhouses, and other public institutions, registrars, and nuisance officers, and that they have free access to all records and books kept by such officers. That the Poor Law Board and the Registrar-General might co-operate with the Privy Council to establish a combination of the Health Office with that which is now proposed by Dr. Farr to be added to the registration machinery; namely, a *Registration Medical Officer* in each superintendent registrar's district, whose duty it would also be to give evidence and make *post-mortem* examinations at coroners' inquests, and to investigate the causes of uncertified or suspicious deaths.

In English seaports no full system of quarantine can be said to have been in action since 1832, when, for reasons I have before mentioned, it failed in excluding cholera. At Southampton steps are taken against the introduction of yellow fever, and at many others a strict watch is kept for cattle plague. In this city I acted under the Privy Council Order in compelling the removal to hospital of sailors ill of cholera; but nothing short of stopping all maritime intercourse with infected countries could be relied on for keeping out that disease. A committee of the Social Science Association, including Dr. Farr, Sir J. Gibson, Sir J. Liddell, Sir J. R. Martin, Dr. Milroy, Prof. Owen, and others, drew up an admirable report on quarantine, from which I will give you a few extracts:

"1. As a general rule, vessels from abroad which have remained free from sickness during their voyage, and on board of which no malignant zymotic disease (chronic maladies not included) exists on arrival, and which are found upon examination to be clean, and to have no putrescent or offensive cargo on board, may be at once admitted to pratique without respect to the country from whence they come. 2. When quarantine detention is deemed necessary, whether from the actual or recent existence of a malignant disease on board, or from the foul and unwholesome state of the vessel, a careful examination should be made of her, and of all persons on board, by the quarantine medical officer, who should have the power and be charged with the responsibility of adopting such

measures as each case demands. The healthy on board need not generally be detained, and the sooner the sick are removed out of the infected vessel to a suitable locality the better. In cases where small-pox is, or has been on board, all unprotected persons, whether among the crew or passengers, should be vaccinated before they are permitted to disperse. 3. Vessels arriving from abroad should be required to pump out their bilge-water, and to have their bilges thoroughly washed out before they are admitted into any crowded harbour or into docks, &c. The hatches also should have been occasionally kept open, and the hold aired as far as possible before arrival and admission. 4. Before *bills of health* are given to a vessel on leaving a port, an examination should be made by a competent person to ascertain her sanitary state, and the health of her crew and all on board; and the particulars should be mentioned in the bill. 5. Medical quarantine officers should be required to keep accurate records of all matters relating to quarantine, and to the condition and circumstances of the shipping (particularly of emigrant and immigrant vessels) arriving in and leaving their ports; and to prepare an *annual report* from the data so procured, for the information of the local authorities; and in this report mention should be made of any epidemic visitation which may have occurred in the place during the year. 6. It would materially conduce to a thorough knowledge of the subject, and probably to the speedy adoption of a more rational and uniform practice generally, if the Government of this country instituted an investigation into the results of quarantine, and the working of quarantine establishments in the chief ports of the south of Europe and of the Mediterranean, where the system is still in greatest force, in order to ascertain the actual truth by personal observation on the spot."

The erection of decent mortuary houses where the coroner, jury, and medical witness, while making the necessary *post-mortem* examination, might be accommodated, has been long advocated in England, and in some districts such have been erected. A very commodious one was constructed a year ago in Fishamble-street, but was abandoned at the request of those living in the vicinity. These inquiries are at present carried on in yards, than which no place could be more unfit, as has been represented by the Police Commissioners, who also complain that the attendance of constables night and day is necessary, to guard the body and prevent mutilation by dogs or rats.

The shortcomings of the coroner's office are described as follows by Dr. Taylor, the first of all medical jurists:

"The conclusion to which experience leads in reference to these inquiries is, that the system affords no certainty for the detection of crime; that it affords no protection to those who are wrongly charged with crime; and lastly, that in some cases it screens a criminal by a verdict based upon an imperfect inquiry, in which the important medical facts are either not understood, or are misinterpreted by the jury. I was once an attendant at a funeral; it was delayed, and the cause of the delay was simply this—an inquest had been held on the body (a case of very sudden death in a state of health), and a verdict of 'death from disease of the heart' had been returned. There had been no inspection of the body. When the grave-clothes were removed, and the body was examined, it was found to be covered with bruises, and some of the muscles of the thigh were reduced to a jelly. Death had been clearly caused by violence. But an inquiry before a coroner for two days had, with all the usual formalities of medical evidence, &c., resulted in a verdict of 'death from disease of the heart.' Within two hours only of the body being put into the ground, it was clearly proved to be an act of murder or manslaughter. The guilty party was tried, convicted, and punished (Key *v.* Hopley). This case, with several others of a similar kind, establishes two propositions. The coroner's inquest affords no certainty for the detection of crime; it in some cases tends to screen a criminal. The secrets of the grave are only known to those who practise medical jurisprudence. In the course of the last thirty years, at least fifteen cases of the exhumation of dead bodies have been referred to me. On some of these, inquests had been held, but no inspections were made. Verdicts of death from cholera or natural causes had been returned, and at intervals of from one month to twenty-two months the bodies have been disinterred, and it has been then proved that the deceased had died from poison. In Scotland the office of coroner does not exist; but in place of this there is an officer named procurator-fiscal, generally a skilled solicitor nominated by competent authority, and not elected by scot-and-lot voters."

In this city, with the acquiescence of both the coroners, the duties of expert or assessor had been performed for fourteen years by a distinguished surgeon, who resigned only on attaining seniority among the leading hospital staff to which he belongs. The arrange-

ment was found most advantageous, because of the greater skill in ascertaining the cause of death, and the consequent detection of crime, which a trained witness possessed over an occasional one. When the deceased person had been attended by any practitioner during life, his evidence was of course received. The arrangement was not continued after this gentleman's resignation. The annual number of inquests held in the city of Dublin is about 220.

In Ireland the coroners of counties are feed for only 67 cases, and those of cities for 86; but in England they are paid for every case they attend, and the office is in many places most valuable. In 1865 there were 24,787 inquests held in England and Wales, and only 3,188 in Ireland, or considerably less than half in proportion to population. The Middlesex justices have applied to the Government for a change in the laws applying to coroners, on the following grounds:

"They feel strong objections to the payment of judicial services by a fixed fee for each case, and especially where it is in the power of the judge to increase or diminish the number of cases almost at his own pleasure, and without any practical safeguard being provided against unnecessary inquiries. It is not fair to the judge himself that such an inducement should be offered to him to hold needless inquests, or that he should be exposed even to the suspicion of doing so. It is unjust to the ratepayers, for it imposes upon them a burthen regulated almost by caprice, and from which they have no appeal. It is contrary to the practice of the entire judicial system of the country, which pays the judges a fixed salary, not measured by the number of cases adjudicated, the country thereby retaining their entire services. Nor does it appear to your committee that the office of coroner is one entitled to an endowment considerably greater than that allotted to a county court judge or a police magistrate."

The *Lancet* upon this remarks:

"The Middlesex magistrates who object to the expense of post-mortem examinations in cases on which coroners' inquiries are held, will probably be startled by the following statement of facts in the report of the Registrar-General for 1864: '4,478 deaths took place in which the causes are "not specified," or "ill-defined;" be-

sides 3,321 sudden deaths in which the causes were investigated, often vainly, by coroners' inquests.'"

Of those deaths for which causes are assigned, a very large number (seventeen per cent. in 1858) are "uncertified" by any medical man. I know myself of two instances in which counties' coroners had made arrangements to employ one medical man constantly upon the consideration of a part of his fee, and as no honourable practitioner would consent, the investigations were usually most imperfectly conducted.

Prof. Taylor is an advocate of introducing into our courts of law, and especially our coroners' courts, experts who, having been especially educated to make medico-legal inquiries, would be more competent to decide than most medical men as at present educated. The system could be easily adopted in large towns, and the country might be divided into districts, so as to obtain an expert in all questions of scientific research in the coroner's court.

In the superior courts, likewise, it is most painful to see crowds of scientific witnesses ranged on each side, and giving evidence on technicalities, the value of which even the judge cannot weigh. Sometimes experts will be retained to prompt counsel in the cross-examination of medical witnesses, and as the questions thus coached up often consist of truisms, misconceptions, and mispronunciations, the proceedings become most ludicrous.

A court of assessors, consisting of able chemists or skilled medical jurists, would give aid which could be relied on, and while the system would prevent much injustice, it would be probably less expensive than the present.

I have not had time throughout these lectures to bring before you the moral elevation which follows in the track of sanitary improvement. More able and far more eloquent speakers have dwelt upon the topic, and it has

been truly said by one of them, "Space, a free atmosphere, and cleanliness, have a great deal to do with the *possibilities* of human virtue."

I trust I have shown you in preceding lectures that medicine, directed by modern sanitary science, has become a productive art, for it has extended the average duration of life to nearer the standard which was ordained for man, by removing many causes of diseases.

I have often before lamented that the elements of physiology or the laws of health were not generally taught, but I will read for you the terms in which sixty-five of the most eminent medcal men in London, some years ago, memorialized Lord Granville, President of the Council of Education:

"Our opinion having been requested as to the advantage of making the elements of human physiology, or a general knowledge of the laws of health, a part of the education of youth, we the undersigned have no hesitation in giving it strongly in the affirmative. We are satisfied that much of the sickness from which the working-classes at present suffer might be avoided; and we know that the best-directed efforts to benefit them by medical treatment are often greatly impeded, and sometimes entirely frustrated, by their ignorance and their neglect of the conditions upon which health necessarily depends. We are therefore of opinion, that it would greatly tend to prevent sickness, and to promote soundness of body and mind, were the elements of physiology in its application to the preservation of health, made a part of general education; and we are convinced that such instruction may be rendered most interesting to the young, and may be communicated to them with the utmost facility and propriety in the ordinary schools, by properly instructed schoolmasters."

To take a single instance—how many thousand infants' lives might be saved, if young females attending national and other schools, were instructed in the duties involved in the care of babies, and crowds of wretched infants might be rescued from disease and accident in cities, if they were cared in some such institution, while their mothers were earning their support abroad by coster-

mongering or daily labour. Every hospital surgeon knows that apart from starvation-diseases children so deserted often fall by burns or scalded throats. Milton well defines the usefulness of such knowledge :

> "Not to know at large of things remote
> From use, obscure and subtle; but to know
> That which before us lies in daily life,
> Is the prime wisdom."

A word or two upon woman's mission in the cause. The Ladies' Sanitary Association in London, of which the Hon. Mrs. W. F. Cowper is President, has done incalculable service by the circulation of tracts, produced by an editing committee consisting of Drs. Farr, Sutherland, Marshall, Richardson, Sieveking, and other eminent sanitarians. A branch was established in Dublin in 1861, and much useful information on sanitary, industrial, and domestic matters was diffused in an entirely unsectarian way. I am afraid, however, that the movement has been very partially successful.

On the 13th of last month two persons were suffocated in a cabin near Castlebar, by burning coal in an unaired room without a fire-place; and on the same night, at Kingstown, in a Maryport schooner, one sailor was killed, and another barely escaped, from having lighted a fire in the forecastle where they usually slept, with a cubic space of about fifty feet! Ignorance mainly did the mischief, but some stringent laws ought to be made for the regulation of merchant ships. Scurvy, unknown in the Navy, is so common among them, that 101 cases were admitted into the *Dreadnaught* Hospital Ship in 1866.

In the following list the result of examinations among ships, made by the Commissioner of the *Bristish Medical Journal* last year, is given :

Name of Ship.	No. of Hands (all told).	Cases of Scurvy.	Results of examination of Lime-juice.
Hermine	17	5	Sulphuric acid.
Merrie England ..	29	10	Stinking.
Mary Fry	23	13	
Stirling Castle ..	32	6	Very weak.
Hoang-Ho	21	5	Acetic acid.
Blanche Moore ..	35	8	Nasty and nauseous.
Saint Andrew's Castle	19	7	Citric acid.
Tamerlane	21	4	Nauseous.
Marlborough ..	23	8	Very weak.
Galloway	29	6	Short allowance.
Tamar	17	2	Very weak.
French Empire ..	27	7 or 8	Citric acid,
Eaglet	14	3	Thick and nasty.
Geelong	14	9	Taken irregularly.
Thorndean	34	2	Spoiled. (Short supply of provisions.)

Nevertheless the fullest knowledge of preventive medicine which man will ever attain will but postpone the day; and the physician, as has been fitly remarked by Prof. Aitken, must, above all, "remember that the sphere of his professional exertion is limited and surrounded by insurmountable barriers, and that death will eventually come alike to all, reminding him that he himself must become a victim to the incompetency of his art."

LECTURE XXIV.

SANITARY LAWS—PROPOSALS FOR CODIFICATION.

No medical practitioner who has treated disease in this country, especially in its populous towns, could have failed to observe the insufficiency of the legal enactments towards its prevention which we possessed up to last year. Upon me this conviction forced itself more urgently, after I was entrusted by the Corporation with the carrying out of the provisions of the Sanitary Acts concerning this city. Having submitted my views to the Sanitary Committee in January, 1865, I was directed to draw out a statement of the differences which existed between Public Health Statutes in England and Ireland. This report was submitted to Sir Robert Peel, then Chief Secretary, and by him referred to Dr. W. N. Hancock, who by directions of his successors, the Right Hon. Mr. Fortescue and Lord Naas, drew up a Health Bill, some clauses of which were embodied in the Sanitary Act passed last session.

I may mention, as remarkable facts, that notwithstanding our present backwardness, the first Sanitary Act for any part of the kingdom (59th Geo. III., cap. 41) was passed for Ireland, and an appeal that its operations should extend to England was made by the famous Dr. Paris and Mr. (afterwards Judge) Fonblanque; that the first Parliamentary Reports on Public Health related to Ireland; and, thirdly, that it was by the notoriously disgraceful state of a Dublin cemetery, Bully's-acre, that public attention was first awakened to the dangers of intramural sepulture.

There is now every hope of amendment of inefficient

sanitary measures, but when I first wrote on the subject I had to profess myself unable to account for the remarkable exclusion of Ireland from many salutary statutes which should be universal in all parts of the United Kingdom. One would presume that even our most independent patriots should rejoice to see our country Anglicized in this respect at least; but up to the present "politics," in the usual narrow sense of that word, have been more attractive to orators and more exciting to constituencies than the health and well-being of the people, which the lawgivers of ancient empires made their chiefest care.

The only important measures which are still exclusively English statutes are, the Public Health Acts, 1848 and 1858, and the Local Government Act, 1858, which renders legislation for any town inexpensive. Their most important provision is the power of instituting investigations into the health and sanitary regulations of any town or place, upon the petition of one-tenth of its inhabitants, or when it appears that its death-rate exceeds 23 per 1,000 (17 per 1,000 being the standard of health).

I would express the hope that any further Act on the subject with which we may be favoured may be comprehensive, some attempt being made to codify the present statutes. Attempts at legislation in sanitary matters have been often patchwork—for example, in 1853, one member brought in a "Bill for the Prevention of Glanders," whilst the various Factory Acts and the Bakehouse Act concern merely a few special employments.

There is probably no division of our statutes which require codification more than those relating to public health. Sanitary provisions have been strung together in a truly miscellaneous fashion. There are none likewise which require more to be assimilated for all parts of the United Kingdom.

The Right Hon. Mr. Cowper describes the change which occurred in England in 1858 as follows:

"For some years we had a distinct sanitary department of the Government represented in Parliament, but it had no power that could be called centralizing in the obnoxious use of that term. It is true, it attempted to guide and to teach, but it had no vocation to coerce. It collected the experience of particular places where experiments had been made, for general information; it published reports on the most pressing and difficult sanitary questions; and its advice was sought from all parts of the country on legal, medical, and engineering difficulties. It aimed at becoming the brain of the sanitary body, diffusing energy and guidance through every limb; but it never assumed the pretension of becoming arms or legs, and of substituting its own action for any other. The powers of the general board of health were doubtless, too limited, and it was taunted with having so little to do. This taunt might have led to the extension of its powers to larger spheres of usefulness, had not its opponents succeeded in its destruction. But out of its ashes rose a phœnix which may hereafter take a higher flight; the council office is charged with the consideration of public health."

The Social Science Association, through Sir B. Brodie, the chairman, presented a petition on this subject, from which the following is an extract:

"Your petitioners are aware that under the Public Health Act passed during the last session of Parliament some provision was made for the kind of action to which they refer; but that enactment, the only one which confers on Government a right of inquiring into evils affecting the public health, was passed but for a single year, and its temporary nature, apart from other defects which it has, must have rendered it almost inoperative. While your petitioners greatly regret that the Act in question should have passed in so unsatisfactory a form, they hope that the necessity thus created for its being reconsidered during the present session of Parliament may lead to its being rendered more effectual for its purpose. Your petitioners therefore earnestly pray that your honourable house will be pleased to re-enact it as a permanent measure with its present essential features preserved, but with such amendments adopted as shall enable her Majesty's Government to make searching inquiry into all cases of excessive local mortality, and to report whether adequate means of prevention are employed by the constituted local authorities."

The medical officer of the Privy Council has often had to report cases of neglect on the part of local authorities, to remedy which compulsory powers were needed; and in his last report he details the case of Malling, in which

the efforts of the Privy Council to abate a nuisance failed. He quotes the opinion of the Attorney and Solicitor-Generals of the late Government upon this case:

"It is evident that the legislature has hitherto thought it sufficient to rely mainly on the vigilance and discretion of the local authorities, without providing against any perverseness or voluntary neglect on their part; and the present case seems to show that in some districts, at all events, further security is required for the public good."

A multiplicity of separate Acts is most inconvenient, and reference to several Acts in using any one, entails much trouble. Mr. Woodhouse, chairman of the Portadown Commissioners, in an able appeal for amendments in the Towns Act, says:

"The people of Scotland applied to Government in 1850 to give them a public Act for the management of their small towns. They were promptly met by Government, and a Bill was introduced granting the Commissioners of the Scotch towns the most ample powers and privileges, carefully compiled together in one Act containing 440 clauses, all of which were read, examined, and passed in two nights sitting of the House of Commons, without a single division. And it went its course through the House of Lords without any difficulty or delay."

The following case will prove the very great disadvantages of having powers under two different Acts:—Tinkler *v.* the Board of Works for the Wandsworth district. A notice had been served upon Mr. Tinkler to pull down some filthy privies attached to about forty cottages, and construct efficient water-closets under the Metropolis Local Management Act, 1865, sec. 81. This order was not complied with. Another notice was served on the owner (also under sec. 81) that they would, if the work were not done, enter the premises and execute the necessary works at his expense. The owner obtained an injunction from the Court of Chancery to restrain the Board from proceeding with the work. On the 19th November, 1857, Vice-Chancellor Sir J. Stuart decided upon the plea, that although the powers

sought to be exercised by the Board of Works were conferred by the Metropolis Local Management Act, he thought, under the Nuisances Removal Act, which gave a more satisfactory appeal to the owner, proceedings should have been taken; the appeal under the former is to the Metropolitan Board of Works; in the latter it is from the magistrate to the quarter sessions. On appeal of the Board from this decision to the Lords Justices, the injunction was confirmed.

On the 16th of August Dr. Hancock reported to Lord Naas the history of the Sanitary Act, 1866, so far as relates to Ireland:

"More than a year ago the attention of Sir Robert Peel, as Chief Secretary, was called to the defective state of the laws as to public health by the town council of Dublin, enclosing the report of Dr. Mapother, their Medical Officer of Health, upon the subject. Sir Robert Peel directed an inquiry into the matter, with a view to legislation. Other local authorities made representations to the Government, and the Poor Law Commissioners intimated their opinion of the unsatisfactory state of the law, so far as it devolved on them to administer it.

"To illustrate the defects complained of, it is sufficient to refer to what happened only one week before the recent Act received the Royal assent. In England precautions against cholera were taken by the Privy Council there putting in force the provisions of the Disease Prevention Act of 1855. In Ireland the Privy Council had to meet the same emergency by issuing orders for putting in force the provisions of the Nuisance Removal and Disease Prevention Acts of 1848 and 1849.

"The provisions thus put in force in Ireland within the last ten days were all repealed for England in 1855, on the grounds, as stated in the recital of the Act of that year, 'That the provisions of the Acts of 1848 and 1849, so far as the same relate to the prevention or mitigation of epidemic, endemic, or contagious diseases, are defective, and it is expedient to substitute other provisions more effectual in that behalf.' Ireland was thus, ten days ago, as to the official powers of meeting the cholera, under the defective provisions of 1848-49, whilst in England the more effectual provisions of 1855 were in force.

"Upon the report to Sir Robert Peel, instructions were given by the late Government to prepare legislation that would put an end

to this unsatisfactory state of affairs, and give Ireland the benefit of all the latest improvements in the law of public health in England. Accordingly, a Bill was drawn extending to Ireland in one statute, arranged in the form of a code the English statutes up to 1865. Before this Bill was introduced into Parliament it was ascertained that a new code of public health was preparing for England. A copy of this was obtained, and the Irish Bill recast to include all the latest improvements. The time spent on political matters prevented the English code being introduced, but instead thereof an Amendment Bill was prepared for England.

"At the period of the session when this Amendment Bill was prepared it became obvious that the only way in which Ireland could by possibility be brought up to the level of English legislation on sanitary matters was by adapting this Bill and all the Acts incorporated to Ireland. Mr. Fortescue proposed this course to the home office authorities, and the Irish clauses were added to the Amendment Bill, and a number of Irishmen were placed on the Special Committee to consider the Bill—Lord Robert Montagu, Sir Frederick Heygate, Sir Colman O'Loghlen, Sir John Gray, Mr. Fortescue, and your Lordship.

"Upon the present Government succeeding to office, your Lordship in the Commons, and the Earl of Belmore in the Lords, took charge of the Irish clauses, and though the general clauses underwent lengthened discussion on the recommittal of the Bill in the Commons, there was no opposition whatever to any of the clauses relating to Ireland, and it is a matter of thankfulness, in the calamity with which we are threatened, that so far as imperial legislation is concerned, the central and local authorities in Ireland have now all the same powers and authorities as have been granted by the legislature to the most favoured portion of the empire.

"If the form in which the measure has been passed is not as perfect as it would have been if a health code had been passed for England, it is better for Ireland to have the Act that has been passed than to have a measure more perfect in form, but to have lost the whole of the increased powers conferred by the Act of 1866, which would have been the case, if the Irish code as prepared at the commencement of the session had alone been passed for Ireland."

It cannot be denied that a more comprehensive and comprehensible Act is to be wished for.

While advocating the extension of sanitary legislative enactments to Ireland, I will not conceal the fact that some of those which are already in force are not taken

full advantage of. I allude to the "Towns Improvement Act," 9th Geo. IV., and to that better statute, the "Towns Improvement Act, 1854." Only ninety-six towns have availed themselves of the advantages of either, and only twenty, according to Dr. Hancock's statistical returns, have appointed surveyors or inspectors of nuisances—officers essentially necessary in carrying out any provision for the sanitary condition of the towns. Thus, about half-a-million of Irish towns-people are living without municipal precautions. The main cause of this neglect in the case of the eighteen towns under the old Act appears to be, that the owners of houses under £5 yearly value are exempted from the rate; and the remedy is to be found in the extension of the operations of the Board of Works to the drainage of towns where sanitary investigations shall demonstrate the prevalence of avoidable disease, and by the extension of these sanitary measures to Ireland which I have endeavoured to show have been attended with such happy results in England.

As Act of Parliament-making is usually regarded as the statesman's or the lawyer's province, I hesitate to interfere; but it may not be presumptuous in one who, although belonging to a profession often regarded as unconcerned in legislative matters, has been freely acting under the defective sanitary laws we possess, to suggest a few amendments and consolidations. I have, therefore, arranged the following propositions, mainly founded on the marginal summaries of English Acts, while the Acts relating to Ireland at present will be found in the Appendix.

The verbiage of a Sanitary Act should be most clear, as magistrates will not act if it be at all ambiguous, and local boards will not undergo the expense of an appeal.

1. Interpretation of terms (10 and 11 Vic., cap. 63,

sec. 2; 17 & 18 Vic., cap. 103, sec. 1). Such words as "owner" or "lodging-house," should be most positively defined; in the Scotch Act (19 and 20 Vic., cap. 103) the word used is "author of nuisance," signifying "the person through whose act or default the nuisance is caused, exists, or is continued, whether he be the owner or occupier, or both; and "common lodging-house" "shall signify a house or part thereof where lodgers are housed at an amount not exceeding threepence per night for each person, whether the same be paid nightly or weekly." "Sanitary authority" seems to me a suitable and inclusive term. Such names as "nuisance authority," "sewer authority," "burial authority," &c., lead to confusion, and the title "chairman of nuisance authority" is such as the leading man of a district would take pride in.

2. The Act to apply to all cities and towns and all unions in Ireland. The Municipal Councils, the Town Commissioners, and the Poor Law Guardians to be the "sanitary authority," and each authority to report annually to Chief Secretary for Ireland (21 and 22 Vic., cap. 98, sec. 12, 13, 14, 15, 16, and 17). Some record of proceedings is surely needed, and the mode adopted in England seems good. The provisions of the above named Act, Local Government, 1858, are very excellent with regard to election of local board and settlement of boundaries, as also t hose of Metropolis Management Act, 1855. This Act, passed through the exertions of Sir B. Hall (now Lord Llanover), sewpt away many obstructive bodies, but there still remained, besides the police commissioners and magistrates, the corporations of London and Westminster, the Metropolitan Board, and the vestries and guardians of thirty-nine districts, to control sanitary matters. A map of London, to show the extent and jurisdiction of the several governing bodies should have fourteen different boundary lines. Enlarge-

ment of districts by union of small ones, is more desirable in Ireland than reduction. There should be some qualification required for a member of committee under sec. 4 of the Sanitary Act.

Mr. Rumsey has forcibly advocated the following amendments in sanitary law.

A. Areas of sanitary administration to be extended, so as to include all outlying suburbs and parishes. B. The whole surface of the country to be divided into sanitary districts, so that every parish may be contained in some sanitary jurisdiction. C. Boundaries of Poor Law Unions (registration districts) to be recognised and generally employed in determining the areas for sanitary administration. D. All local boards, sewer and nuisance authorities, &c., to be combined and incorporated within every such sanitary district. E. Constitution of local sanitary authorities to be reformed, by adding persons possessing other qualifications than those now required under various enactments. F. A single central department to be adequately empowered, and aided by divisional inspectors, for purposes of investigation, direction, and control. G. Various provisions of former Sanitary Acts to be consolidated, methods of procedure to be simplified, and power to initiate proceedings to be vested in persons authorized to act as public prosecutors. H. The qualifications and tenure of office of the several classes of officers employed in sanitary administration to be determined by law, or by the central authority. I. Medical officers of health and registration, acting also as medical jurists, to be appointed in the several sanitary districts, on the condition suggested in the preceding pages."

3. Sanitary authorities should all be corporations for the purpose of suing and being sued.

4. Local authority to make bye-laws for the prevention of nuisances, especially from trades, and for the conduct of officers; to be confirmed by Chief Secretary.

The Local Government Office London has framed most excellent bye-laws, which are usually adopted by local boards, so that great uniformity exists.

5. The Lord Lieutenant in council may direct inquiries, and may appoint an officer who shall report annu-

ally on the state of towns; or for the purpose an inspector shall be appointed by the Poor Law Commissioners (21 and 22 Vic., cap. 97, sec. 3, 4, and 5; 21 and 22 Vic., cap. 98, sec. 79). Such is necessary, to see that occasional inspections which, under the 20th section of the Sanitary Act, 1866, are now compulsory, are carried out. By the 16th section the officer of police is made the superior authority to discover any default of sanitary duty in the local board; but it may be asserted the necessary technical knowledge is not possessed. The clause in the bill giving such power to competent persons was struck out, and, indeed, unless there was some means for providing them without local expense, the most unwholesome conditions would remain in many places. In the Scotch Sanitary Act, 1856, which is the most comprehensive and well-managed ever passed in these kingdoms, two householders may complain of the default of the local authority to the sheriff, who shall then hold an investigation.

6. The Board of Public Works to be the officers provided for the supervision of all works constructed in accordance with this Act (21 and 22 Vic., cap. 98, sec. 79 and 80).

7. Upon petition of a certain proportion of householders, or when the deaths in any district appear on the Registrar-General's returns to be above a proportion of 23 per 1,000 of the population, the inspector of the Privy Council or Poor-law Commission to make local inquiry (11 and 12 Vic., cap. 63, sec. 8).

8. After inquiry, in certain cases the Act shall be put in force by order of the Lord Lieutenant in council (11 and 12 Vic., cap. 63, sec. 10). The tenement-house clause (35) of the Sanitary Act can only be put in force when the local authority applies to the Lord Lieutenant.

9. Local authority shall appoint a clerk, officer of health, surveyor, and inspector of nuisances, and make bye-laws for the due performance of their duties (11 & 12 Vic., cap. 63, sec. 37, 38, 39, 40). In my Fifteenth Lecture I gave evidence that a permissive clause on this matter will be disregarded.

It has been suggested that the constabulary, instead of relieving officers, should carry out the provisions of the Nuisances Act, and that they should receive part of the fines. As this force is more than twice as numerous with us as the analogous body in England, and as their time is not fully occupied, except on occasions of political excitement, there seems to be no objection to the arrangement. Under the present system it is undeniable that an epidemic is often at its height before any precautionary steps are taken, and we have no means to "stamp it out."

10. New streets and new buildings shall be built according to plans fixed on by the local authority, with regard to structure of walls, airing, draining, and the provision of yard space of at least 100 square feet, to every house.—21 & 22 Vic. cap. 98, sec. 34, &c.

Many English towns possess admirable Building Acts. In Liverpool the authorities are empowered to open all courts which at present are *cul-de-sacs*—a desideratum most truly in this city, if our municipal funds would justify the expenditure.

By the 22nd section of the Birmingham Act, 1861, it is enacted—

"Seven Days at the least before beginning to dig or lay out the Foundation of or for any new House or Building, or to rebuild any House or Building pulled down, to or below the floor, generally called the Ground Floor, the Person intending so to build or rebuild, shall give to the Council or Surveyor of the Borough written Notice thereof, mentioning the intended level of the Cellars or lowest Floor, and the situation of the Privies and Cess-pools or Drains to be built, constructed or used in connection with such House or Building; and shall at the same time deposit with the

Surveyor Plans of the same, drawn on a Scale, with a Block Plan of the site, shewing the proposed Lines of the Drainage of the House or Building, and the Size, Depth, and the Inclination of such Drains; and it shall not be lawful to begin to build or rebuild any such House or Building, or to build or to construct any such Privy, Cesspool, or Drain until the Particulars so required to be stated, and the said Plans shall have been approved by the Council or their Surveyor; and in default of such Notice being given or Plans deposited, or if any such House, Building, Privy, Cesspool or Drain be built, rebuilt, or constructed as aforesaid, without such approval, or in any respect in Deviation from the said Plans, or contrary to the Provisions of this Act and the recited Act, or of any Act incorporated therewith, the Offenders shall be liable for every such offence to a Penalty not exceeding Twenty Pounds, and the Council may, if they shall think fit, cause such House, Building, Privy, Cesspool, or Drain, to be altered, pulled down, or otherwise dealt with as the case may require, and the expenses incurred by them in so doing shall be repaid by the offender, and be recoverable from him as damages: provided always, that if the Council or their Surveyor fail to signify their or his approval or disapproval of the said Particulars and Plans for the space of Seven Days after due service of the Notice and Deposit of the Plans, it shall be lawful to proceed according to such Notice and plans."

And by the 51st section of the said Act it is also enacted that—

"The external walls of all buildings exceeding one storey in height, erected after the commencement of this Act, within the borough, shall be throughout of a thickness of not less than nine inches."

11. Houses to be purified, and damp earth under floors to be replaced by suitable matter, on certificate of officer of health, or of two medical practitioners.—11 & 12 Vic. cap. 63, section 60.

12. All sewers shall be vested in local authority, who may cause to be prepared a map, exhibiting the sewerage of the district, and shall make, alter, or discontinue sewers.—11 & 12 Vic. cap. 63, secs. 41, 43, and 45.

The Sewage Utilization Act, 1865, which will be found in the Appendix, has been taken advantage of in a few cases.

13. No new house shall be erected without a drain, and local authority may, upon report of surveyor that any house is without a drain, cause one to be constructed; the expense to be recoverable from the owner.—11 and 12 Vict. cap. 63, sec. 49.

The works should be superintended by the officers of the local authority.

14. Local authority shall provide a proper supply of watef for the district, as by the sections of the Public Health Act, extended to Ireland by the Sanitary Act, 1866, and may compel all houses to be supplied at a rate not exceeding 2d. per week. Fountains and drinking troughs for cattle should be provided.

15. In towns of over 5000 inhabitants, all houses in which lodgings are let shall be regulated under the Sanitary Act, 1866, sec. 35. This was granted by the Act last August, but I am not aware that bye-laws under it are yet in force in any town except Dublin.

16. Local authority of towns may erect and maintain lodging-houses, and borrow money for the purpose from the Public Works Loan Commissioners.

This was granted last session under the Labourers' Dwellings Act, to towns, public bodies, and estated individuals. The application from Dublin is the only one I have heard of.

17. The word "nuisances" shall include any premises in such a state from insufficiency of size or other circumstance, as to be a nuisance or injurious to health —any well, foul ditch, gutter, water-course, privy, urinal, cesspool, drain, or ashpit, so foul as to be a nuisance or injurious to health, any animal so kept as to be a nuisance injurious to health, any accumulation or deposit which is a nuisance or injurious to health.—19 & 20 Vict. cap. 103, sec. 18.

Mr. T. Barkers defines nuisances, and cites illustrative cases:—

"By the Common Law anything which causes injury to the neighbourhood, or to the natural rights of property, is a nuisance. No actual injury need have happened, it is sufficient if the thing complained of be likely to produce it. (*R.* v. *Vantandillo*, 4 M. & S., 73.) Thus a building so constructed as to exclude light from other buildings previously existing; any noxious manufacture polluting the air or water; the stoppage of a water-course, &c., are nuisances. And it has been established by numerous decisions that no length of time will legitimate a nuisance. The remedy is by indictment, or, in private nuisances, by action. *R.* v. *Pappineau*, 1 Stra., 686.) But the nuisance may, in certain cases, be removed by the suffering party (*Earl of Lonsdale* v. *Nelson*, 2 Q. B., 311.) It is not necessary that a public nuisance should be injurious to health, nor will the presence of one nuisance justify another; if there be smells offensive to the sense that is enough, as the neighbourhood has a right to fresh and pure air, so also have persons passing along the highway (*R.* v. *Neil*, 2 C. & P., 85.)

Under the 29th section of the Nuisances Act, 1855, now extended to Ireland, the London magistrates adjudge all rooms to be overcrowded which do not allow 500 cubic feet for each adult, and 300 for each child. It would he better to have this proportion defined as it is in the *General Police and Improvement (Scotland) Act*, 1862, in which, however, the allowance is not sufciently liberal, for it declares that each person over eight years shall have 300 cubic feet of space, and under that age 150, and that no room having less than 700 cubic feet in space shall be the exclusive dwelling of one family. In the Dublin and many other bye-laws, under the lodging-house section of the Public Health Act, 300 cubic feet is the standard.

There are hundreds of dwellings recorded in our "Sanitary Register" at the City Hall as having developed fever and other contagious diseases, in which overcrowding existed to the utmost, and yet no amendment was possible until the Legislature conferred on us the Public Health Act. The following instance, by Dr. Gairdner, the Medical Officer of Health for Glasgow,

demonstrates the marvellous effect of thinning inhabitants in the prevention of typhus. The house No. 83 Drygate-street, aptly termed "the Rookery," consisted of 48 separate tenements, with an average of 4 persons to each room, each individual having 126 cubic feet of space, or one-fourth of the minimum space allowed for each soldier according to the Barracks Commission. In this building 39 cases of typhus had arisen during the year ending June 30th, 1863. Under the Police Act the tenements were thinned, and although fever in the city had doubled, and was prevalent in the very street, but once case occurred in the Rookery during the succeeding year.

The sentence requiring the house to be occupied by more than one family should be omitted, as it is in the Scotch Act, 1856, for it excludes from any amendment many wretched cabins and stables (for even such places are converted to the purpose of human habitation), and which are greatly over-crowded. Any person who will visit Ball's-yard (a closed court off Meath-street), will find several houses consisting of a single room, of about 1,200 cubic feet in space, thronged with six, seven or eight human beings, and such dwellings are, moreover, not touched by the Common Lodging House Acts.

18. Food unsafe for use should be treated as a nuisance. The 26th section of the Nuisances Act, 1855, requires some change, for a London magistrate refused to recognise a decoction of putrid horse-livers, sold as catsup, as being within the meaning of the clause.

The smoke from a factory is a nuisance under Sanitary Act, 1866, but not that of a private house—an injurious distinction which the committee on the Bill struck out.

19. No offensive trade shall be newly established without the consent of local authority, as is the case in

the Towns Act, 1854; but Dublin, for instance, is without any such provision, which is an example out of many of the need for assimilation of municipal law. That measures with regard to trades must be well defined and stringent, the following case will shew:—

Proceedings were taken against the owner of a chemical factory, in which gas liquor was used for making alum, a fearfully poisonous stench being emitted, as was abundantly proved. The defendant alleged that many other nuisances were produced in the same neighbourhood, and upon this pretext the magistrate dismissed the summons, remarking that the whole force of the law could not make the place pleasant to live in. Commenting on this case, the *Times* remarked "One nuisance, it is evident, can be made to protect another, and fifty in a lump will be perfectly unassailable."

The Buildings Act (England), 7 & 8 Vict., c. 84, sec. 55, provides that any person who shall establish or newly carry on any one of certain offensive businesses, therein enumerated, within fifty feet from a dwelling-house, shall be liable to a penalty of £50 a day.

20. A clause similar to that in the Metropolis Act, 1862, directing licensing of cow-houses, and thereby giving powers to compel sewerage, water supply, and to prevent overcrowding in them, and the retention of manure, is very desirable. Such seems now more necessary than ever, when there is dread of ivnasion by the cattle plagne, which has re-appeared in the sheds in Islington, where it began in June, 1865.

Cowsheds are not well drained, as the owners do not wish to lose the liquid manure; the refuse is often stored till it becomes quite offensive. They are always overcrowded, 1000 cubic feet of space being the proper amount for a cow, and the paving and the water supply is often very bad. Yet attempts to improve the state of things is often met with assertions entirely unfounded,

that "nothing is so wholesome as the smell of a cow-house." On the contrary, these conditions lead to the development and spread of disease amongst the stock, and the consequent deterioration of the milk or flesh of the animal.

21. Lord Lieutenant in Council empowered to issue orders for prevention of epidemic disease when prevalent, providing for the speedy interment of the dead, and house to house visitation.

The provisions of the Diseases Prevention Act are so good, that it is a pity it is not permanent.

22. Local authority shall provide carriages for conveyance of infected persons.

So great is the evil resulting from cabs being used for small-pox and other contagious cases, that the provision of special vehicles should be compulsory, and a notice stating where they are to be had should be posted at every cab-stand. The 24th clause of the Sanitary Act, 1866, is merely permissive on the point.

23. Local authority may remove sick persons from lodging-houses to hospital.—19 and 20 Vict., c. 103, sec. 38.

The Contagious Diseases Prevention Act, 1864, is directed against a disease which taints, perhaps, every fortieth babe, and engrafts hereditary maladies on one-fourth of our race, yet which is repressible, to some extent, at least, by coercive measures. It is to be in force for three years in English military and naval stations, and in Ireland at the Curragh, Cork, and Queenstown only; but if successful, I trust all the larger cities in Ireland may share its advantages.

24. Local authority shall be the Burial Board.—21 and 22 Vic. cap. 98, sec. 49 and 19, and 20 Vic. cap. 98.

25. The Lord Lieutenant in Council or Poor Law Commissioners may appoint a duly qualified inspector to examine the state of existing burial grounds, and the suitability of the sites of any which may be proposed.—18 and 19 Vic. cap. 128, sec. 8.

In my 14th Lecture I endeavored to shew that some such superintendence was needed, and I will now quote that eminent legal authority, Mr. Thomas Baker, to prove the advantageous results in England.

"During the twelve years since the passing of the first Burial Act in 1852, a great sanitary revolution, as regards the burial of the dead, has quietly taken place in this country. Within this period, some four hundred local Burial Boards have been constituted, and there is scarcely a market town of any consequence which has not already provided, or is now engaged in providing, adequate means for the decent interment of its dead beyond the dwellings of the living. During these twelve years, also, about five hundred Orders in Council have been issued, by which near four thousand old burial grounds, belonging to religious professors of all denominations, have been either closed or placed under regulation. Perhaps the majority of these consisted of mere scraps of ground wedged in, as it were, between densely inhabited districts; each church or chapel being surrounded with its own precinct of corruption. In the new cemeteries, which are commodious and well drained, sufficient space is provided for all sects and all ranks, uniting thus, after the petty contentions and distinctions of life are over, 'all sorts and conditions of men' into one common fold. Not surcharged burial grounds alone, but the use of vaults under places of worship, have been discontinued under these Acts. Accordingly, in the Metropolis only, nearly one hundred church vaults—each, for the most part, occupying the entire space beneath the building—have been thoroughly disinfected and permanently built up. An interesting illustration of the cordial manner with which this great social reform has been received by the ratepayers of England, is afforded by the fact that a sum exceeding £1,400,000 has been already raised for the provision of the parochial cemeteries in question. The interment of the dead beneath and around churches has been called a 'distinctive feature of Christian burial;' but the persons who make this assertion forget that burial in the time of Christ was extramural. The Widow of Nain was following her son out of the city. Lazarus was interred in a cave beyond Bethany. The demoniac at Gadara, dwelling among the tombs near the coast, met Jesus as he approached towards the town; and

the Holy Sepulchre was in a garden outside Jerusalem. So far from condemning this custom, our Saviour, in one of his strongest figures, would seem to indicate an approval of it: the hypocritical Pharisees were compared to 'whited sepulchres—full of dead men's bones and all uncleanness.' The truth is, that we owe the introduction of 'Church burial' to the superstitious observances of the dark ages."

26 Local authority may erect and manage markets, and manufacture gas. Considerable profit would accrue, and might be expended on sanitary improvements.

27. Local authority may lay out grounds for recreation of adults, and play grounds for children.

This was made the subject of a special act for England and Ireland (22 Vic. cap. 27), but I am not aware that it has been taken advantage of in this country.

28. The local authority shall be the authority for carrying out the provisions of the Bakehouse Regulation Act (26 and 27 Vic. cap. 40), and shall exercise the powers conferred by the Towns Police Clauses Act, 1847, in the following matters:—Obstructions in streets, fires, places of public resort, hackney carriages, bathing, and also powers conferred by Towns Improvement Clauses Act, 1847, for naming streets and numbering houses, improving streets, removing dangerous buildings, supply of water, prevention of smoke, slaughter-houses, clocks, and public libraries.

The above and other minor acts surely need amalgamation into a code for the regulation of all matters relating to the government of towns.

29. Simplification of forms in taking legal steps. Great obstruction is experienced from the verbosity of the forms of the Nuisances Act (quoted in the Appendix).

The mode of legal proceedings directed by Public Health Act, 1848, and amended by Local Government Act, 1858, seem most advisable.

As also are those directing auditing of accounts. Un-

willingness to pay taxes for sanitary purposes would diminish if it was felt that the money was judiciously expended.

The clauses relating to borrowing powers of these acts are vastly superior to those of the Towns Act, 1854 (Ireland). Loans for the drainage of estates have been freely granted, and are more necessary for the drainage of towns. The taking of land for public purposes, with due compensation, should be granted to sanitary authorities without the expense of a private Act of Parliament.

APPENDIX.

29 & 30 *Vic., cap.* 90—*An Act to amend the Law relating to the Public Health*, 1866.

WHEREAS it is expedient to amend the law relating to Public Health, be it enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same as follows:

Preliminary—Short Title of Act.

1. This Act may be cited for all purposes as the Sanitary Act, 1866.

PART I.—AMENDMENT OF THE SEWAGE UTILIZATION ACT, 1865.

Definition of "Sewer Authority"—"Lord Lieutenant in Council."

2. "Sewer authority" in this Act shall have the same meaning as it has in the Sewage Utilization Act, 1865. The words "Lord Lieutenant in Council" shall mean in this Act the Lord Lieutenant or any Chief Governor or Chief Governors in Ireland, acting by and with the consent of Her Majesty's Privy Council in Ireland.

This part to be construed with 28 *&* 29 *Vict., cap.* 75.

3. This part of this Act shall be construed as one with the Sewage Utilization Act, 1865, and the expression, "The Sewage Utilization Act, 1865," as used in this or any other Act of Parliament or other document, shall mean the said Sewage Utilization Act, 1865, as amended by this Act.

Power to Sewer Authority to form Committee of its own members and others.

4. Any sewer authority may from time to time, at any meeting specially convened for the purpose, form one or more committee or committees consisting wholly of its own members, or partly of its own members and partly of such other persons contributing to the rate or fund out of which the expenses incurred by such authority are paid, and qualified in such other manner as the sewer authority may determine, and may delegate, with or without conditions or restrictions, to any committee so formed, all or any powers of such sewer authority, and may from time to time revoke, add to, or

alter any powers so given to a committee. A committee may elect a chairman of its meetings. If no chairman is elected, or if the chairman elected is not present at the time appointed for holding the same, the members present shall choose one of their number to be chairman of such meeting. A committee may meet and adjourn as it thinks proper. The quorum of a committee shall consist of such number of members as may be prescribed by the sewer authority that appointed it, or if no number be prescribed, of three members. Every question at a meeting shall be determined by a majority of votes of the members present, and voting on that question; and in case of an equal division of votes, the chairman shall have a second or casting vote. The proceedings of a committee shall not be invalidated by any vacancy or vacancies amongst its members. A sewer authority may from time to time add to or diminish the number of the members, or otherwise alter the constitution of any committee formed by it, or dissolve any committee. A committee of the sewer authority shall be deemed to be the agents of that authority, and the appointment of such committee shall not relieve the sewer authority from any obligation imposed on it by Act of Parliament or otherwise.

Formation of Special Drainage District.

5.* Where the sewer authority of a district is a vestry, select vestry, or other body of persons acting by virtue of any Act of Parliament, prescription, custom, or otherwise as or instead of a vestry or select vestry, it may, by resolution at any meeting convened for the purpose, after twenty-one clear days notice affixed to the places where parochial notices are usually affixed in its district, form any part of such district into a special drainage district for the purposes of the Sewage Utilization Act, and thereupon such special drainage district shall, for the purposes of the Sewage Utilization Act, 1865, and the powers therein conferred, be deemed to be a parish in which a rate is levied for the maintenance of the poor, and of which a vestry is the sewer authority, subject, as respects any meeting of the inhabitants thereof in vestry, to the Act of the 58th year of the reign of King George III., cap. 69, and the Acts amending the same; and any officer or officers who may from time to time be appointed by the sewer authority of such special drainage districts for the purpose shall have within that district all the powers of levying a rate for the purpose of defraying the expense of carrying the said Sewage Utilization Act into effect that they would have if such district were such parish as aforesaid, and such rate were a rate for the relief of the poor, and they were duly appointed overseers of such parish.

* Sects. 5, 6, 7, appear not applicable to Ireland.

Appeal against constitution of Special Drainage District.

6. Where the sewer authority of any place has formed a special drainage district in pursuance of this Act, if any number of the inhabitants of such place, not being less than twenty, feel aggrieved by the formation of such district, or desire any modification in its boundaries, they may by petition in writing under their hands, bring their case under the consideration of one of her Majesty's principal Secretaries of State, and the said Secretary of State may after due investigation annul the formation of the special drainage district or modify its boundaries as he thinks just.

Evidence of formation of Special Drainage District.

7. A copy of the resolution of a sewer authority forming a special drainage district shall be published by affixing a notice thereof to the church door of the parish in which the district is situate, or of the adjoining parish if there be no church in the said parish, and by advertising notice thereof in some newspaper published or circulating in the county in which such district is situate; and the production of a newspaper containing such advertisement, or a certificate under the hand of the clerk or other officers performing the duties of clerk for the time being of the sewer authority which passed the resolution forming the district, shall be evidence of the formation of such district, and after the expiration of three months from the date of the resolution forming the district, such district shall be presumed to have been duly formed, and no objection to the formation thereof shall be entertained in any legal proceedings whatever.

Power to drain into Sewers of Sewer Authority.

8. Any owner or occupier of premises within the district of a sewer authority shall be entitled to cause his drains to empty into the sewers of that authority, on condition of his giving such notice as may be required by that authority of his intention so to do, and of complying with the regulations of that authority in respect of the mode in which the communications between such drains and sewers are to be made, and subject to the control of any person who may be appointed by the sewer authority to superintend the making of such communications; but any person causing any drain to empty into any sewer of a sewer authority without complying with the provisions of this section shall incur a penalty not exceeding £20, and it shall be lawful for the sewer authority to close any communication between a drain and sewer made in contravention of this section, and to recover in a summary manner from the person so offending any expenses incurred by them under this section.

Use of Sewers by persons beyond District.

9. Any owner or occupier of premises beyond the limits of the district of a sewer authority, may cause any sewer or drain from such premises to communicate with any sewer of the sewer authority, upon such terms and conditions as may be agreed upon between such owner or occupier and such sewer authority, or in case of dispute may, at the option of the owner or occupier, be settled by two justices or by arbitration in manner provided by the Public Health Act, 1848, in respect of matters by that Act authorised or directed to be settled by arbitration.

As to the drainage of houses.

10. If a dwelling house within the district of a sewer authority is without a drain, or without such drain as is sufficient for effectual drainage, the sewer authority may by notice require the owner of such house within a reasonable time therein specified to make a sufficient drain emptying into any sewer which the sewer authority is entitled to use, and with which the owner is entitled to make a communication, so that such sewer be not more than 100 feet from the site of the house of such owner; but if no such means of drainage are within that distance, then emptying into such covered cesspool or other place, not being under any house, as the sewer authority directs; and if the person on whom such notice is served fails to comply with the same, the sewer authority may itself, at the expiration of the time specified in the notice, do the work required, and the expenses incurred by it in so doing may be recovered from such owner in a summary manner.

Supply of Water to District of Sewer Authority.

11. A sewer authority within its district shall have the same powers in relation to the supply of water that a local board has within its district, and the provisions of the sections herein-after mentioned shall apply accordingly in the same manner as if in such provisions "sewer authority" were substituted for "local board of health" or "local board," and the district in such provisions mentioned were the district of the sewer authority and not the district of the local board; that is to say, the sections numbered from 75 to 80, both inclusive, of the Public Health Act, 1848, sections 51, 52, and 53 of the Local Government Act, 1858, and section 20 of the Local Government Act, 1858, Amended Act, 1861. The sewer authority may, if it think it expedient so to do, provide a supply of water for the use of the inhabitants of the district by (1) Digging wells; (2) Making and maintaining reservoirs; (3) Doing any other necessary acts; and they may them-

selves furnish the same, or contract with any other persons or companies to furnish the same: provided always, that no land be purchased or taken under this clause except by agreement or in manner provided by the Local Government Act, 1858.

Expenses of Sewer Authority in supplying water.

12. Any expenses incurred by a sewer authority in or about the supply of water to its district, and in carrying into effect the provisions herein-before in that behalf mentioned, shall be deemed to be expenses incurred by that authority in carrying into effect the Sewage Utilization Act, 1865, and be payable accordingly.

Wells, &c., belonging to any place vested in Sewer Authority, &c. 23 & 24 Vict. cap. 77, sec. 7.

13. All property in wells, fountains, and pumps, and powers in relation thereto, vested in the nuisance authority by the 7th section of the act passed in the session of the 23rd and 24th years of the reign of her present Majesty, chapter 77, shall vest in the sewer authority, where the sewer authority supplies water to its district.

Part II.—Amendment of the Nuisances Removal Acts.

Definition of "Nuisances Removal Acts."

14. The expression "Nuisances Removal Acts" shall mean the Acts passed in the years following of the reign of her present Majesty, that is to say, the one in the session of the eighteenth and nineteenth years, chapter 121, and the other in the session of the twenty-third and twenty-fourth years, chapter seventy-seven, as amended by this part of this Act; and this part of this Act shall be construed as one with the said Acts, and all expenses incurred by a nuisance authority in carrying into effect any of the provisions of this part of this Act shall be deemed to be expenses incurred by it in carrying into effect the Nuisances Removal Acts.

Definition of "Nuisance Authority."

15. "Nuisance Authority" shall mean any authority empowered to execute the Nuisances Removal Acts.

Power of Police with respect to Nuisances.

16. In any place within the jurisdiction of a nuisance authority the chief officer of police within that place, by and under the directions of one of her Majesty's principal secretaries of state,* on

* In Ireland by the Lord Lieutenant.

its being proved to his satisfaction that the nuisance authority has made default in doing its duty, may institute any proceeding which the nuisance authority of such place might institute with respect to the removal of nuisances: provided always, that no officer of police shall be at liberty to enter any house or part of a house used as the dwelling of any person without such person's consent, or without the warrant of a justice of the peace, for the purpose of carrying into effect this Act.

Section 3 of 23 & 24 Vict. c. 77, repealed.

17. The third section of the said Act of the session of the twenty-third and twenty-fourth years of the reign of her present Majesty, chapter 77, shall be repealed, and all powers vested in any highway board or "Nuisance Removal Committee" under the Nuisances Removal Acts shall determine, and all property belonging to them for the purposes of the said Nuisances Removal Acts shall, subject to any debts or liabilities affecting the same, be transferred to or vested in the nuisance authority under the said Acts: provided always, that this section shall not extend to any vestry or district board, under the Act of the session of eighteenth and nineteenth years of the reign of her present Majesty, chapter 120, intituled *An Act for the better Local Management of the Metropolis* (18 & 19 Vict. c. 120), or to any committee appointed by such vestry or district board for the purpose of carrying into effect the Nuisances Removal Acts or any of them.

Requisition of ten inhabitants equivalent to certificate of Medical Officer.

18. A requisition in writing under the hands of any ten inhabitants of a place shall for the purposes of the twenty-seventh section of "The Nuisances Removal Act for England, 1855," be deemed to be equivalent to the certificate of the medical officer or medical practitioners therein mentioned, and the said section shall be enforced accordingly.

Addition to definition of Nuisance.

19. The word "nuisances" under the Nuisance Removal Acts shall include,* 1. Any house or part of a house so overcrowded as to be dangerous or prejudicial to the health of the inmates. 2. Any factory, workshop, or workplace not already under the operation of any general Act for the regulation of factories or bakehouses, not kept in a cleanly state, or not ventilated in such a manner as to render harmless as far as practicable any gases, vapours, dust, or other impurities generated in the course of the

* Additional to those in Nuisances Act, 1855.

work carried on therein that are a nuisance or injurious or dangerous to health, or so overcrowded while work is carried on as to be dangerous or prejudicial to the health of those employed therein. 3. Any fireplace or furnace which does not as far as practicable consume the smoke arising from the combustible used in such fireplace or furnace, and is used within the district of a nuisance authority for working engines by steam, or in any mill, factory, dyehouse, brewery, bakehouse, or gaswork, or in any manufactory or trade process whatsoever. Any chimney (not being the chimney of a private dwelling house) sending forth black smoke in such quantity as to be a nuisance. Provided, first, that in places where at the time of the passing of this Act no enactment is in force compelling fireplaces or furnaces to consume their own smoke, the foregoing enactment as to fireplaces and furnaces consuming their own smoke shall not come into operation until the expiration of one year from the date of the passing of this Act. Secondly, that where a person is summoned before the justices in respect of a nuisance arising from a fireplace or furnace which does not consume the smoke arising from the combustible used in such fireplace or furnace, the justices may hold that no nuisance is created within the meaning of this Act, and dismiss the complaint, if they are satisfied that such fireplace or furnace is constructed in such manner as to consume as far as practicable, having regard to the nature of the manufacture or trade, all smoke arising therefrom, and that such fireplace or furnace has been carefully attended to by the person having the charge thereof.

Duties of Nuisance Authorities as to inspection of Nuisances, &c.

20. It shall be the duty of the nuisance authority to make from time to time, either by itself or its officers, inspection of the district, with a view to ascertain what nuisances exist calling for abatement under the powers of the Nuisance Removal Acts, and to enforce the provisions of the said Acts in order to cause the abatement thereof, also to enforce the provisions of any Act that may be in force within its district requiring fireplaces and furnaces to consume their own smoke; and any justice upon complaint upon oath may make an order to admit the nuisance authority or their officers for these purposes, as well as to ground proceedings under the eleventh section of the Nuisances Removal Act, 1855.

As to proceedings of Nuisance Authority under sec. 12 *of* 18 *and* 19 *Vict. c.* 121.

21. The nuisance authority or chief officer of police shall, previous to taking proceedings before a justice under the twelfth section of the Nuisances Removal Act, 1855, serve a notice on the

person by whose act, default, or sufferance the nuisance arises or continues, or, if such person cannot be found or ascertained, on the owner or occupier of the premises on which the nuisance arises, to abate the same, and for that purpose to execute such works and to do all such things as may be necessary within a time to be specified in the notice: Provided, first, that where the nuisance arises from the want or defective construction of any structural convenience, or where there is no occupier of the premises, notice under this section shall be served on the owner. Secondly, that where the person causing the nuisance cannot be found, and it is clear that the nuisance does not arise or continue by the act, default, or sufferance of the owner or occupier of the premises, then the nuisance authority may itself abate the same without further order, and the cost of so doing shall be part of the costs of executing the Nuisances Removal Acts, and borne accordingly.

Power to cause premises to be cleansed or otherwise disinfected.

22. If the nuisance authority shall be of opinion, upon the certificate of any legally qualified medical practitioner, that the cleansing and disinfecting of any house or part thereof, and of any articles therein likely to retain infection, would tend to prevent or check infectious or contagious disease, it shall be the duty of the nuisance authority to give notice in writing requiring the owner or occupier of such house or part thereof to cleanse and disinfect the same as the case may require; and if the person to whom notice is so given fail to comply there-with within the time specified in the notice, he shall be liable to a penalty of not less than 1*s.*, and not exceeding 10*s.* for every day during which he continues to make default; and the nuisance authority shall cause such house or part thereof to be cleansed and disinfected, and may recover the expenses incurred from the owner or occupier in default in a summary manner; when the owner or occupier of any such house or part thereof as is referred to in this section is from poverty or otherwise unable in the opinion of the nuisance authority, effectually to carry out the requirements of this section, such authority may without enforcing such requirements on such owner or occupier, with his consent, at his own expense, cleanse and disinfect such house or part thereof and any articles therein likely to retain infection.

Power to provide means for disinfection.

23. The nuisance authority in each district may provide a proper place, with all necessary apparatus and attendance, for the disinfection of woollen articles, clothing, or bedding which have become infected, and they may cause any articles brought for disinfection to be disinfected free of charge.

Nuisance Authorities may provide carriages for conveyance of infected persons.

24. It shall be lawful at all times for the nuisance authority to provide and maintain a carriage or carriages suitable for the conveyance of persons suffering under any contagious or infectious disease, and to pay the expense of conveying any person therein to a hospital or place for the reception of the sick or to his own home.

Penalty on persons suffering from infectious disorder entering public conveyance without notifying to driver that he is so suffering.

25. If any person suffering from any dangerous infectious disorder shall enter any public conveyance without previously notifying to the owner or driver thereof that he is so suffering, he shall on conviction thereof before any justice be liable to a penalty not exceeding £5, and shall also be ordered by such justice to pay to such owner and driver all the losses and expenses they may suffer in carrying into effect the provisions of this act; and no owner or driver of any public conveyance shall be required to convey any person so suffering until they shall have been first paid a sum sufficient to cover all such losses and expenses.

Removal of persons sick of infectious disorders and without proper lodging, in any District.

26. Where a hospital or place for the reception of the sick is provided within the district of a nuisance authority, any justice may with the consent of the superintending body of such hospital or place, by order on a certificate signed by a legally qualified medical practitioner, direct the removal to such hospital or place for the reception of the sick, at the cost of the nuisance authority, of any person suffering from any dangerous contagious or infectious disorder, being without proper lodging or accommodation, or lodged in a room occupied by more than one family, or being on board any ship or vessel.

Places for the reception of dead bodies may be provided at the public expense.

27. Any nuisance authority may provide a proper place for the reception of dead bodies, and where any such place has been provided and any dead body of one who has died of any infectious disease is retained in a room in which persons live or sleep, or any dead body which is in such a state as to endanger the health of the inmates of the same house or room is retained in such house or room, any justice may, on a certificate signed by a legally qualified medical practitioner, order the body to be removed to such proper place of reception at the cost of the nuisance authority, and direct

the same to be buried within a time to be limited in such order; and unless the friends or relations of the deceased undertake to bury the body within the time so limited, and do bury the same, it shall be the duty of the relieving officer to bury such body at the expense of the poor rate, but any expense so incurred may be recovered by the relieving officer in a summary manner from any person legally liable to pay the expense of such burial.

Places for the reception of dead bodies during time required for post-mortem examination may be provided.

28. Any nuisance authority may provide a proper place (otherwise than at a work-house or at a mortuary house as lastly hereinbefore provided for) for the reception of dead bodies for and during the time required to conduct any *post-mortem* examination ordered by the Coroner of the district or other constituted authority, and may make such regulations as they may deem fit for the maintenance, support, and management of such place; and where any such place has been provided, any Coroner or other constituted authority may order the removal of the body for carrying out such *post-mortem* examination and the re-removal of such body, such costs of removal and re-removal to be paid in the same manner and out of the same fund as the cost and fees for *post-mortem* examinations when ordered by the Coroner.

Power to remove to hospitals sick persons brought by ships.

29. Any nuisance authority may with the sanction of the Privy Council,* signified in manner provided by "The Public Health Act, 1858," lay down rules for the removal to any hospital to which such authority is entitled to remove patients, and for keeping in such hospital so long as may be necessary any persons brought within their district by any ship or boat who are infected with a dangerous and infectious disorder, and they may by such rules impose any penalty not exceeding £5 on any person committing any offence against the same.

Provision as to district of Nuisance Authority extending to places where ships are lying.

30. For the purposes of this Act any ship, vessel, or boat that is in a place not within the district of a nuisance authority shall be deemed to be within the district of such nuisance authority as may be prescribed by the Privy Council, and until a nuisance authority has been prescribed then of the nuisance authority whose district nearest adjoins the place where such ship, vessel, or boat is lying, the distance being measured in a straight line, but nothing

* In Ireland the Lord Lieutenant in Council.

in this Act contained shall enable any nuisance authority to interfere with any ship, vessel, or boat that is not in *British* waters.

Power of entry to Nuisance Authority or their officer under sect. 11 of 18 & 19 Vict. cap. 121.

31. The power of entry given to the authorities by the 11th section of the Nuisances Removal Act, 1855, may be exercised at any hour when the business in respect of which the nuisance arises is in progress or is usually carried on. And any justice's order once issued under the said section shall continue in force until the nuisance has been abated, or the work for which the entry was necessary has been done.

Provision as to ships within the jurisdiction of Nuisance Authority.

32. Any ship or vessel lying in any river, harbour, or other water shall be subject to the jurisdiction of the nuisance authority of the district within which such river, harbour, or other water is, and be within the provisions of the Nuisances Removal Acts, in the same manner as if it were a house within such jurisdiction, and the master or other officer in charge of such ship shall be deemed for the purpose of the Nuisances Removal Acts to be the occupier of such ship or vessel; but this section shall not apply to any ship or vessel belonging to her Majesty or to any foreign government.

Provision for raising money in divided parishes.

33. Where the guardians are the nuisance authority for part of any parish only, and shall require to expend money on account of such part in execution of the provisions of the said Acts, the overseers of the parish shall, upon receipt of an order from the said guardians, raise the requisite amount from the persons liable to be assessed to the poor rate therein by a rate to be made in like manner as a poor rate, and shall have all the same powers of making and recovering the same, and of paying the expense of collecting the rate when made, and shall account to the auditor of the district for receipt and disbursement of the same, in like manner, and with the same consequences, as in the case of the poor rate made by them.*

Nuisance Authority may require payment of costs or expenses from owner or occupier, and occupier paying to deduct from rent.

34. That it shall be lawful for the nuisance authority, at their discretion, to require the payment of any costs or expenses which the owner of any premises may be liable to pay under the said Nuisances Removal Acts or this Act, either from the owner or

* Not applicable to Ireland.

from any person who then or at any time thereafter occupies such premises, and such owner or occupier shall be liable to pay the same, and the same shall be recovered in manner authorised by the Nuisance Removal Acts, and the owner shall allow such occupier to deduct the sums of money which he so pays out of the rent from time to time becoming due in respect of the said premises, as if the same had been actually paid to such owner as part of such rent: provided always, that no such occupier shall be required to pay any further sum than the amount of rent for the time being due from him, or which, after such demand of such costs or expenses from such occupier, and after notice not to pay his landlord any rent without first deducting the amount of such costs or expenses, becomes payable by such occupier, unless he refuse, on application being made to him for that purpose by or on behalf of the nuisance authority, truly to disclose the amount of his rent and the name and address of the person to whom such rent is payable, but the burden of proof that the sum demanded from any such occupier is greater than the rent due by him at the time of such notice, or which has since accrued, shall lie upon such occupier; provided also, that nothing herein contained shall be taken to affect any contract made or to be made between any owner or occupier of any house, building, or other property whereof it is or may be agreed that the occupier shall pay or discharge all rates, dues, and sums of money payable in respect of such house, building, or other property, or to affect any contract whatsoever between landlord or tenant.

PART III.—MISCELLANEOUS.

In cities, boroughs, or towns, Secretary of State, on application of Nuisance Authority, may empower them to make regulations as to lodging houses.

35. On application to one of her Majesty's principal Secretaries of State by the nuisance authority of the city of London, or any district or parish included within the Act for the better local government of the metropolis, or of any municipal borough, or of any place under the Local Government Act, 1858, or any local improvement Act, or of any city or town containing, according to the census for the time being in force, a population of not less than 5,000 inhabitants, the Secretary of State* may, as he may think fit, by notice to be published in the *London Gazette*,† declare the following enactment to be in force in the district of such nuisance authority, and from and after the publication of such notice, the nuisance authority shall be empowered to make regulations for the

* In Ireland the Lord Lieutenant. † *Dublin Gazette.*

following matters: that is to say, (1). For fixing the number of persons who may occupy a house or part of a house which is let in lodgings or occupied by members of more than one family: (2). For the registration of houses thus let or occupied in lodgings; (3). For the inspection of such houses, and the keeping the same in a cleanly and wholesome state: (4). For enforcing therein the provision of privy accomodation and other appliances and means of cleanliness in proportion to the number of lodgings and occupiers, and the cleansing and ventilation of the common passages and staircases: (5). For the cleansing and lime-whiting at stated times of such premises: The nuisance authority may provide for the enforcement of the above regulations by penalties not exceeding 40*s.* for any one offence, with an additional penalty not exceeding 20*s.* for every day during which a default in obeying such regulations may continue; but such regulations shall not be of any validity unless and until they shall have been confirmed by the Secretary of State: But this section shall not apply to common lodging houses within the provisions of the Common Lodging Houses Act, 1851, or any Act amending the same.

Cases in which two convictions have occurred within three months.

36. Where two convictions against the provisions of any Act relating to the overcrowding of a house, or the occupation of a cellar as a separate dwelling place, shall have taken place within the period of three months, whether the persons so convicted were or were not the same, it shall be lawful for any two justices to direct the closing of such premises for such time as they may deem necessary, and in the case of cellars occupied as aforesaid, to empower the nuisance authority to permanently close the same, in such manner as they may deem fit, at their own cost.

Power to provide hospitals.

37. The sewer authority, or in the metropolis the nuisance authority, may provide for the use of the inhabitants within its district hospitals or temporary places for the reception of the sick. Such authority may itself build such hospitals or places of reception, or make contracts for the use of any existing hospital or part of a hospital, or for the temporary use of any place for the reception of the sick. It may enter into any agreement with any person or body of persons having the management of any hospital for the reception of the sick inhabitants of its district, on payment by the sewer authority of such annual or other sum as may be agreed upon. The carrying into effect this section shall in the case of a sewer authority be deemed to be one of the purposes of the said Sewage Utilization Act, 1865, and all the provisions of the said Act shall apply accordingly. Two or more authorities having re-

spectively the power to provide separate hospitals may combine in providing a common hospital, and all expenses incurred by such authorities in providing such hospital shall be deemed to be expenses incurred by them respectively in carrying into effect the purposes of this Act.

Penalty on any person with infectious disorder exposing himself, or on any person in charge of such sufferer causing such exposure.

38. Any person suffering from any dangerous infectious disorder who wilfully exposes himself, without proper precaution against spreading the said disorder, in any street, public place, or public conveyance, and any person in charge of one so suffering who so exposes the sufferer, and any owner or driver of a public conveyance who does not immediately provide for the disinfection of his conveyance after it has, with the knowledge of such owner or driver, conveyed any such sufferer, and any person who without previous disinfection gives, lends, sells, transmits, or exposes any bedding, clothing, rags, or other things which have been exposed to infection from such disorders, shall on conviction of such offence before any justice, be liable to a penalty not exceeding £5: provided that no proceedings under this section shall be taken against persons transmitting with proper precautions any such bedding, clothing, rags, or other things for the purpose of having the same disinfected.

Penalty on persons letting houses in which infected persons have been lodging.

39. If any person knowingly lets any house, room, or part of a house in which any person suffering from any dangerous infectious disorder has been to any other person without having such house, room, or part of a house, and all articles therein liable to retain infection, disinfected to the satisfaction of a qualified medical practitioner as testified by a certificate given by him, such person shall be liable to a penalty not exceeding £20. For the purposes of this section the keeper of an Inn shall be deemed to let part of a house to any person admitted as a guest into such Inn.

Guardians, &c., of the poor to be the Local Authorities for executing Diseases Prevention Act.

40. Where in any place two or more boards of guardians or local authorities have jurisdiction, the Privy Council* may, by any order made under the Diseases Prevention Act, 1855, authorize or require such Boards to act together for the purposes of that Act, and may prescribe the mode of such joint action and of defraying the costs thereof.

* In Ireland the Lord Lieutenant in Council.

Evidence of family in case of over-crowded houses.

41. In any proceedings under the Common Lodging Houses Act 1851, if the inmates of any house or part of a house allege that they are members of the same family, the burden of proving such allegation shall lie on the persons making it.

Extension to the whole of England and Ireland of sect. 67 *of* 11 & 12 *Vict, cap.* 63.

42. The 67th section of the Public Health Act, 1848, relating to cellar dwellings, shall apply to every place in England and Ireland where such dwellings are not regulated by any other Act of Parliament, and in applying that section to places where it is not in force at the time of the passing of this Act the expression "this Act" shall be construed to mean the "Sanitary Act, 1866" and not the said "Public Health Act, 1848." In construing the said 67th section as applied by this Act nuisance authority shall be substituted for the local board.

Local Board in certain cases may adopt Baths and Wash-houses Acts.

43. Local boards acting in execution of the Local Government Act, 1858, may adopt the Act to encourage the establishment of public baths and wash-houses, and any Act amending the same, for districts in which those Acts are not already in force, and when they have adopted the said Acts they shall have all the powers, duties, and rights of commissioners under the said Acts; and all expenses incurred by any local board in carrying into execution the Acts referred to in this section shall be defrayed out of the general district rates, and all receipts by them under the said Acts shall be carried to the district fund account.

Power to Burial Boards in certain cases to transfer their powers to Local Board.

44. When the district of a burial board is conterminous with the district of a local board of health, the burial board may by, resolution of the vestry, and by agreement of the burial board and local board, transfer to the local board all their estate, property, rights, powers, duties, and liabilities, and from and after such transfer the Local Board shall have all such estate, property, rights, powers, duties, and liabilities as if the Local Board had been appointed a burial board by order in council under the 4th section of the Act of the session of the 20th and 21st years of the reign of her present Majesty, cap. 81.

Penalty for wilful damage of works.

45. If any person wilfully damages any works or property belonging to any local board, sewer authority, or nuisance authority, he shall be liable to a penalty not exceeding £5.

Incorporation of Sanitary Authorities.

46. The following bodies, that is to say, local boards, sewer authorities, and nuisance authorities, if not already incorporated, shall respectively be bodies corporate designated by such names as they may usually bear or adopt, with power to sue and be sued in such names, and to hold lands for the purposes of the several acts conferring powers on such bodies respectively in their several characters of local boards, sewer authorities, or nuisance authorities.

Extent of authority to make provisional orders respecting lands under sect. 75 of 21 & 22 Vict, sect. 98.

47. The authority conferred on one of her Majesty's principal Secretaries of State by section 75 of the Local Government Act, 1858, to empower by provisional order a local board to put in force, with reference to the land referred to in such order, the powers of the Lands Clauses Consolidation Act, 1845, with respect to the purchase and taking of lands otherwise than by agreement, shall extend and apply and shall be deemed to have always extended and applied to every case in which, by the Public Health Act, 1848, and the Local Government Act, 1858, or either of them, or any Act extending or amending those Acts, or either of them, a local board are authorized to purchase, provide, use or take lands or premises for any of the purposes of the said Acts, or either of them, or of any such Act as aforesaid; and sections 73 and 84 of the Public Health Act, 1848, shall be construed as if the words "by agreement" therein respectively used had been expressly repealed by section 75 of the Local Government Act, 1858.

Appearance of Local Authorities in legal proceedings.

48. Any local board, sewer authority, or nuisance authority may appear before any justice or justices, or in any legal proceeding, by its clerk or by any officer or member authorized generally or in respect of any special proceeding by resolution of such board or authority, and such person being so authorized shall be at liberty to institute and carry on any proceeding which the nuisance authority is authorized to institute and carry on under the Nuisance Removal Acts or this Act.

Mode of proceeding where Sewer Authority has made default in providing sufficient sewers, &c.

49. Where complaint is made to one of her Majesty's principal

Secretaries of State that a sewer authority or local board of health has made default in providing its district with sufficient sewers, or in the maintenance of existing sewers, or in providing its district with a supply of water in cases where danger arises to the health of the inhabitants from the insufficiency or unwholesomeness of the existing supply of water, and a proper supply can be got at a reasonable cost, or that a nuisance authority has made default in enforcing the provisions of the Nuisance Removal Acts, or that a local board has made default in enforcing the provisions of the Local Government Act, the said Secretary of State, if satisfied after due inquiry made by him that the authority has been guilty of the alleged default, shall make an order limiting a time for the performance of its duty in the matter of such complaint; and if such duty is not performed by the time limited in the order, the said Secretary of State shall appoint some person to perform the same, and shall by order direct that the expenses of performing the same, together with a reasonable remuneration to the person appointed for superintending such performance, and amounting to a sum specified in the order, together with the costs of the proceedings, shall be paid by the authority in default; and any order made for the payment of such costs and expenses may be removed into the Court of Queen's Bench, and be enforced in the same manner as if the same were an order of such Court.

Recovery of certain expenses of water supply.

50. All expenses incurred by a sewers authority or local board in giving a supply of water to premises under the provisions of the 76th section of the Public Health Act, 1848, or the 51st section of the Local Government Act, 1858, and recoverable from the owners of the premises supplied, may be recovered in a summary manner.

Power to reduce penalties imposed by 6 *G.* iv., *cap.* 78.

51. All penalties imposed by the Act of the 6th year of King George IV., cap. 78, intituled "An Act to repeal the several laws relating to quarantine, and to make other provisions in lieu thereof," may be reduced by the justices or court having jurisdiction in respect of such penalties to such sum as the justices or Court think just.

Description of vessels within provisions of 6 *G.* iv., *cap.* 78.

52. Every vessel having on board any person affected with a dangerous or infectious disorder shall be deemed to be within the provisions of the Act of the 6th year of King George IV., cap. 78, although such vessel has not commenced her voyage, or has come

from or is bound for some place in the United Kingdom; and the Lords and others of her Majesty's Most Honourable Privy Council, or any three or more of them (the Lord President of the Council or one of her Majesty's principal Secretaries of State being one), may, by order or orders to be by them from time to time made, make such rules, orders, and regulations as to them shall seem fit, and every such order shall be certified under the hand of the Clerk in Ordinary of her Majesty's Privy Council, and shall be published in the *London Gazette*, and such publication shall be conclusive evidence of such order to all intents and purposes; and such orders shall be binding and be carried into effect as soon as the same shall have been so published, or at such other time as shall be fixed by such orders, with a view to the treatment of persons affected with cholera and epidemic, endemic and contagious disease, and preventing the spread of cholera and such other diseases as well on the seas, rivers and waters of the United Kingdom, and on the high seas within three miles of the coasts thereof, as on land; and to declare and determine by what nuisance authority or authorities such orders, rules, and regulations shall be enforced and executed; and any expenses incurred by such nuisance authority or authorities shall be deemed to be expenses incurred by it or them in carrying into effect the Nuisances Removal Acts.

Periodical removal of manure in mews, &c.

53. Where notice has been given by the nuisance authority, or their officer or officers, for the periodical removal of manure or other refuse matter from mews, stables, or other premises (whether such notice shall be by public announcement in the locality or otherwise), and subsequent to such notice the person or persons to whom the manure or other refuse matter belongs shall not so remove the same, or shall permit a further accumulation, and shall not continue such periodical removal at such intervals as the nuisance authority, or their officer or officers, shall direct, he or they shall be liable without further notice, to a penalty of 20*s.* per day for every day during which such manure or other refuse matter shall be permitted to accumulate, such penalty to be recovered in a summary manner: provided always, that this section shall not apply to any place where the Board of Guardians or Overseers of the poor are the nuisance authority.

Recovery of penalties.

54. Penalties under this Act, and expenses directed to be recovered in a summary manner, may be recovered before two justices in manner directed by an Act passed in the session holden in the 11th and 12th years of the reign of her Majesty Queen Victoria,

cap. 43, intituled "An Act to facilitate the performance of the duties of justices of the peace out of sessions within England and Wales with respect to summary convictions and orders, or any Act amending the same.

Powers of Act cumulative.

55. All powers given by this Act shall be deemed to be in addition to and not in derogation of any other powers conferred on any local authority by Act of Parliament, law, or custom, and such authority may exercise such other powers in the same manner as if this Act had not passed.

PART IV.—APPLICATION OF ACT TO IRELAND.

Modifications necessary for application of Part I. to Ireland.

56. In applying the first part of this Act to Ireland the following changes shall be observed: (1). The provisions of the sections numbered from 75 to 80 both included, of the Public Health Act, 1848, and sections 51, 52, and 53 of the Local Government Act, 1858, and section 20 of the Local Government Act, 1858, Amendment Act, 1861, referred to in the first part of this Act, shall for all purposes connected with the execution of this Act be extended to Ireland: (2). The Sewage Utilization Act, 1865, shall be amended by substituting in Ireland the sewer authority, as defined by the first schedule to this Act, for the sewers authority as defined by said Act.

Modifications necessary for application of Part II. to Ireland.

57. The Nuisance Removal Acts as amended by the second part of this Act shall apply to Ireland; provided, however, that in such application the following changes shall be observed: (1). Sewer authority as defined by the Sewage Utilization Act, 1865, and amended by this Act, shall in Ireland be the nuisance authority for executing the Nuisance Removal Acts: (2). The expenses of executing the Nuisance Removal Acts shall be defrayed out of the funds herein-after provided: (3). The penalties shall be recovered in the manner herein-after provided: (4). The expressions "Mayor, Aldermen, and Burgesses," "Council," "Borough Rate," "Borough Fund," and "Town Rate," shall in the first schedule hereto have respectively the same meaning as in the Acts for the regulation of Municipal Corporations in Ireland: (5). For the purposes of the 22nd section of the Nuisance Removal Act, 1855, the nuisance authority shall in Ireland have the power of entering land conferred by the Sewage Utilization Act, 1865, and shall have the

same power of levying asse sments under the said section that they have of levying any other rates they are authorized by law to impose.

How expenses to be defrayed in Ireland when Nuisance Authority not a Board of Guardians.

58. In Ireland, the nuisance authority, not being the guardians of the poor, shall pay all expenses incurred by them in carrying the Nuisance Removal Acts into effect out of the fund in the first schedule in that behalf mentioned, and where such fund arises wholly or in part from rates shall have, in addition to their existing powers of rating all such powers for making and levying any extra rate, if necessary, respectively, as in the case of any rate authorized to be made under the provisions of the respective Acts of Parliament under which the nuisance authorities are constituted or authorized to levy rates; and all provisions of such Acts respectively shall be applicable in respect thereof; provided that when the rates to be assessed by such authority are limited by law to a certain rateable amount, such limitation shall not apply or extend to expenses incurred in carrying this Act into execution; and it shall be lawful for such authority to assess the expenses under this Act in addition to such limited assessments.

When Board of Guardians is Nuisance Authority, how expenses to be defrayed in Ireland.

59. In Ireland, a nuisance authority, being guardians of the poor, shall pay all expenses incurred by them in carrying this Act into effect out of the poor rates of the Union, and charge the same to the Union, or any electoral division or electoral divisions thereof, in such manner as the Poor Law Commissioners shall from time to time, by general orders applicable to classes of cases, or by order in any particular case, direct.

Recovery of penalties in Ireland.

60. In Ireland, penalties under this Act and expenses or compensation directed to be recovered in a summary manner, and nuisances and other offences liable to be prosecuted summarily, shall be recovered and prosecuted in manner directed by the Petty Sessions (Ireland) Act, 1851, or any Act amending the same; and all penalties recovered by any authority under this Act shall be paid to them respectively, and by them applied in aid of their expenses under this Act. Any order authorized to be made by justices under this Act shall be deemed to be an order made upon a complaint on which justices are authorized to make orders under the last-mentioned Act.

Modifications necessary for application of Part III. to Ireland.

61. In applying the provisions of Part III. of this Act to Ireland the following changes shall be observed: (1.) Applications for power to make regulations as to lodging houses may be made by any nuisance authority, except a board of guardians, and shall be made to the Lord Lieutenant in council, and the said Lord Lieutenant in council shall have the power of declaring the enactments as to lodging houses in the third part of this Act to be in force in any nuisance district: (2.) The said Lord Lieutenant in council shall have and exercise the power in respect of boards of guardians acting together, vested in the Privy Council by the said third part of this Act: (3.) In Ireland any nuisance authority, except a board of guardians, may exercise the powers conferred on local boards acting in the execution of the Local Government Act, 1858, by the said third part of this Act: (4.) Sewer and nuisance authorities in Ireland shall be incorporated for the purposes of this Act by the names set forth in the said first schedule hereto; and such sewer or nuisance authorities may hold lands by such names for the purposes of Burial Ground (Ireland) Act, 1856: (5.) The penalties under the third part of this Act shall be recovered in like manner as herein-before provided with respect to penalties under the second part of this Act.

Modifications necessary for application of Disease Prevention Act to Ireland.

62. The Diseases Prevention Act, 1855, as amended by the Nuisance Removal and Disease Prevention Amendment Act, 1860, and this Act shall extend to Ireland: provided, however, that in such application the following changes shall be observed: (1.) The Lord Lieutenant in council shall have the power with respect to Ireland which the Privy Council has under such provisions for prevention of disease in England: (2.) The commissioners for administering the laws for the relief of the poor in Ireland, hereinafter called the Poor Law Commissioners, shall be the authority in Ireland for issuing regulations to carry the provisions of said Act into effect: (3.) The regulations of the Poor Law Commissioners shall be authenticated in like manner as orders of theirs under the Dispensary Act, 1851, stat. 14 & 15 Vict., cap. 68, sect. 8 (sect. 2 ?): (4.) In defraying the expenses of the prevention of disease out of the poor rate of the Union under this Act the guardians of the poor shall charge the same to the Union, or any dispensary district or electoral division or divisions thereof, in such manner as the Poor Law Commissioners shall from time to time by general orders applicable to classes of cases, or by orders in particular cases, direct.

Committee and Officers under Dispensaries Act to aid Local Authority in execution of this Act.

63. In Ireland, all committees, inspectors, medical officers, and other persons appointed or employed under the powers of statute 14th and 15th Victoria, cap. 68 (the Dispensaries Act, 1851), shall and they are hereby required within their respective districts to aid the local authority, and such officers or persons as they shall appoint or employ, in the superintendence and execution of any directions and regulations which may at any time be issued by the Poor Law Commissioners for the time being under the authority and by virtue of this Act.

The provisions of 14 & 15 *Victoria, cap.* 68, *as to duties and appointment of Medical Inspectors in Ireland incorporated with this Act.*

64. In Ireland the provisions of the Dispensary Act, 1851 (statute 14th and 15th Vict., cap. 68), with respect to the duties and appointment of medical inspectors, shall be incorporated with this Act, and the prevention of disease and inquiry into public health under this Act, shall be deemed one of the purposes for which such medical inspectors have been or may be appointed, in like manner as if its provisions had been referred to in the said Act of 1851, instead of the provisions of the said Nuisance Removal and Diseases Prevention Act of 1848.

Remuneration to Medical Practitioners for services under the directions and regulations of the Poor Law Commissioners in Ireland.

65. In Ireland, whenever in compliance with any direction or regulation of the Poor Law Commissioners which they may be empowered to make under the laws for the time being as to the public health, any medical officer of a union or dispensary district, or any other medical practitioner specially employed by the guardians for the purpose, shall perform any extra medical service in any union or part of a union, it shall and may be lawful for the guardians of the union to determine, subject to the approval of the said commissioners, and if they shall not approve the amount determined by the guardians, for the said commissioners to fix by order under their seal, such remuneration, proportioned to the nature and extent of such services as aforesaid as to them shall appear just and reasonable; and the amount of such remuneration shall be paid to such medical officer or other medical practitioner by the guardians of the union out of the rates raised for the relief of the poor, and shall be charged either to the union at large, or to such part or parts of the union, according to the nature of the case, as the said commissioners shall in each case direct.

Poor Law Commissioners to make inquiries as to public health in Ireland.

66. The Lord Lieutenant in council may from time to time direct the Poor Law Commissioners to cause to be made such inquiries as the Lord Lieutenant in council see fit in relation to any matters concerning the public health in any place or places in Ireland, and the Poor Law Commissioners shall report the result of such inquiries to the Lord Lieutenant in council.

Publication in Ireland to be made in Dublin Gazette.

67. Publication shall be made in the *Dublin Gazette* in any case in Ireland where publication in the *London Gazette* is required in England.

Powers in Secretary of State in England to be exercised in Ireland by the Lord Lieutenant in Council.

68. All powers relating to the execution of this Act in England and by this Act vested in one of her Majesty's principal Secretaries of State, shall, with regard to the execution of this Act in Ireland, in all cases not herein-before expressly provided for, be vested in the Lord Lieutenant or other Chief Governor or Governors of Ireland; and all powers relating to the execution of this Act in England, and by this Act vested in the Privy Council in England, shall, with regard to the execution of this Act in Ireland, in all cases not herein-before expressly provided for, be vested in the Lord Lieutenant in council in Ireland.

Repeal of statutes applicable to Ireland.

69. From and after the passing of this Act the Acts set forth in the second schedule hereto shall be repealed, so far as they are still in force: provided always, that all proceedings commenced or taken under the said Acts and not yet completed may be proceeded with under said Acts, and that all contracts and works undertaken by virtue of said Acts shall continue and be effective as if said Acts had not been repealed.

FIRST SCHEDULE.—*Application to Ireland.*

Description of Sewers and Nuisance Authority in Ireland.	Description of Sewers and Nuisance District in Ireland.	Corporate Name, for the purposes of suing or being sued, or holding Property, under the Provisions of this Act.	Rate or Fund out of which Expenses incurred by Sewers or Nuisance Authority under this Act to be defrayed.
The Rt. Hon. the Lord Mayor, Aldermen and Burgesses acting by the Town Council.	The City of Dublin.	The Rt. Hon. the Lord Mayor, Aldermen, and Burgesses of the City of Dublin.	The Borough Rate or Borough Fund.
The Mayor, Aldermen, and Burgesses, acting by the Town Council.	Towns Corporate, with exception of Dublin.	The Mayor, Aldermen, and Burgesses of the City or Town of ——	The Borough or Bo Fund.
The Town Commissioners.	Towns having Town Commissioners, under the Towns' Improvement (Ireland) Act, 1854, or under any Local Act.	The Town Commissioners of ——	Any Rate levied by the Commissioners.
The Township Commissioners.	Townships having Commissioners under Local Acts.	The Township Commissioners of ——	
The Commissioners appointed by the 9th of George IV., intituled "An Act to make Provision for the lighting, cleansing, and watching of Cities and Towns Corporate and Market Towns in Ireland.	Towns under such Commissioners.	The Lighting and Cleansing Commissioners of the Town of ——	
The Municipal Commissioners.	Towns having Municipal Commissioners, under 3 & 4 Vic., c. 108,	The Municipal Commissioners of ——	The Town Fund.
The Guardians of the Poor of each Union.	Such part of each Union as is not under another Sewer or Nuisance Authority.	The Guardians of the Poor of the —— Union.	The Poor Rate of Union.

SECOND SCHEDULE.—*Statutes Repealed.*

Local Boards of Health Act for Ireland, 1818; Statute 58 Geo. III., c. 47, ss. 10 to 15, inclusive. Officers of Health Act for Ireland, 1819; Statute 59 Geo. III., c. 41. Nuisance Removal and Disease Prevention Act, 1848. Nuisance Removal and Disease Prevention Act, 1849.

18 & 19 *Vic., cap.* 121.—*An Act to consolidate and amend the Nuisances Removal and Diseases Prevention Acts.*

WHEREAS the provisions of "The Nuisances Removal and Diseases Prevention Act, 1848" (11 and 12 Vict., cap. 123), amended by "The Nuisances Removal and Diseases Prevention Amendment Act, 1849" (12 and 13 Vict., cap. 111), are defective, and it is expedient to repeal the said Acts as far as relates to England, and to substitute other provisions more effectual in that behalf: Be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

Recited Acts repealed, except as to proceedings commenced.

1. From and after the passing of this Act the said Acts are by this section repealed as far as relates to England (and Ireland): provided always that all proceedings commenced or taken under the said Acts, and not yet completed, may be proceeded with under the said Acts; and all contracts or works undertaken by virtue of the said Acts shall continue and be as effectual as if the said Acts had not been repealed.

Interpretation of certain terms used in this Act.

2. In this Act the following words and expressions have the meanings by this section herein-after assigned to them, unless such meanings be repugnant to or inconsistent with the context (that is to say), the word "place" includes any city, borough, district under the Public Health Act, parish, township, or hamlet, or part of any such city, borough, district, town, parish, township, or hamlet; the word "guardians" includes the directors, wardens, overseers, governors, or other like officers having the management of the poor for any parish or place where the matter or any part of the matter requiring the cognizance of any such officer arises; the word "borough," and the expressions "mayor, aldermen, and burgesses," "council" and "borough fund," have respectively the same meaning as in the Acts for the regulation of Municipal Corporations, and shall also respectively mean, include, and apply to any royal borough, royal town, or other town having a warden, high bailiff, borough reeve, or other chief officer, and burgesses or inhabitants, however designated, associated with him in the government or management thereof, or any town or place having a governing body therein in the nature of a Corporation or other-

wise, and to the chief officers and governing bodies of such boroughs, towns, and places, and to the funds and property under the management of or at the disposal of such chief officers and governing bodies; the expression "Improvement Act" means an Act for regulating and managing the police of, and for draining, cleansing, paving, lighting, watching, and improving a place, and an Act for any of those purposes; the word "owner" includes any person receiving the rents of the property in respect of which that word is used from the occupier of such property on his own account, or as trustee or agent for any other person, or as receiver or sequestrator appointed by the Court of Chancery or under any order thereof, or who would receive the same if such property were let to a tenant; the word "premises" extends to all messuages, lands, or tenements, whether open or inclosed, whether built on or not, and whether public or private; the word "parish" includes every township or place separately maintaining its poor or separately maintaining its own highways; the expression "quarter sessions" means the court of general or quarter sessions of the peace for a county riding, or division of a county, city, or borough; the word "person" and words applying to any person or individual, apply to and include Corporations, whether aggregate or sole; and the expression "two justices" shall, in addition to its ordinary signification, mean one stipendiary or police magistrate acting in any police court for the district.

[Sec. 3 repealed, and 4 relates only to England].

Part I.

And with respect to the constitution of the local authority for the execution of this Act, the expenses of its execution, the description of nuisances that may be dealt with under it, and the powers of entry for the purposes of the Act, be it enacted thus:

Power to Authority to appoint Committees.

5. The local authority may appoint any committee of their own body to receive notices, take proceedings, and in all or certain specified respects execute this Act, whereof two shall be a quorum; and such local authority, or their committee, may, in each particular case, by order in writing under the hand of the chairman of such body or committee, empower any officer or person to make complaints and take proceedings on their behalf.

[Secs. 6 and 7 repealed].

What are deemed Nuisances under this Act.

8. The word "nuisances" under this Act shall include—any premises in such a state as to be a nuisance or injurious to health:

Any pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ashpit, so foul as to be a nuisance or injurious to health: Any animal so kept as to be a nuisance or injurious to health: Any accumulation or deposit which is a nuisance or injurious to health: Provided always, that no such accumulation or deposit as shall be necessary for the effectual carrying on of any business or manufacture shall be punishable as a nuisance under this section, when it is proved to the satisfaction of the justices that the accumulation or deposit has not been kept longer than is necessary for the purposes of such business or manufacture, and that the best available means have been taken for protecting the public from injury to health thereby.

[Sec. 9 repealed].

Notice of Nuisances to be given to Authority, &c., to ground proceedings.

10. Notice of nuisance may be given to the local authority by any person aggrieved thereby, or by any of the following persons; the sanitary inspector or any paid officer under the said local authority; two or more inhabitant householders of the parish or place to which the notice relates; the relieving officer of the union or parish; any constable or any officer of the constabulary or police force of the district or place; and in case the premises be a common lodging house, any person appointed for the inspection of common lodging houses; and the local authority may take cognizance of any such nuisance after entry made as herein-after provided, or in conformity with any Improvement Act under which the inspector has been appointed.

Power of Entry to Authority or their Officer.

11. The local authority shall have power of entry for the following purposes of this Act, and under the following conditions 1.: To ground proceedings. For this purpose, when they or any of their officers have reasonable grounds for believing that a nuisance exists on any private premises, demand may be made by them or their officer, or any person having custody of the premises, of admission to inspect the same at any hour between nine in the morning and six in the evening; and if admission be not granted, any justice having jurisdiction in the place may, on oath made before him of belief in the existence of the nuisance, and after reasonable notice of the intended application to such justice being given in writing to the party on whose premises the nuisance is believed to exist, by order under his hand require the person having the custody of the premises to admit the local authority or their officer; and if no person having custody of the premises can be discovered,

any such justice may and shall, on oath made before him of belief in the existence of such nuisance, and of the fact that no person having custody of the premises can be discovered, by order under his hand authorize the local authority or their officers to enter the premises between the hours aforesaid. 2. To examine premises where nuisances exist, to ascertain the course of drains, and to execute or inspect works ordered by justices to be done under this Act. For these purposes, whenever, under the provisions of this Act, a nuisance has been ascertained to exist, or when an order of abatement or prohibition under this Act has been made, or when it becomes necessary to ascertain the course of a drain, the local authority may enter on the premises, by themselves or their officers between the hours aforesaid, until the nuisance shall have been abated, or the course of the drain shall have been ascertained, or the works ordered to be done shall have been completed, as the case may be. 3. To remove or abate a nuisance in case of non-compliance with or infringement of the order of justices, or to inspect or examine any carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour, under the powers and for the purposes of this Act. For this purpose the local authority or their officer may from time to time enter the premises where the nuisance exists, or the carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour is found, at all reasonable hours, or at all hours during which business is carried on on such premises, without notice.

Part II.

With regard to the removal of nuisances, be it enacted thus:

If proved to Justice that Nuisance exists, &c., they shall issue order for abatement.

12. In any case where a nuisance is so ascertained by the local authority to exist, or where the nuisance in their opinion did exist at the time when the notice was given, and although the same may have been since removed or discontinued, is in their opinion likely to recur or to be repeated on the same premises or any part thereof, they shall cause complaint therof to be made before a Justice of the Peace; and such justice shall thereupon issue a summons requiring the person by whose act, default, permission, or sufferance the nuisance arises or continues, or if such person cannot be found or ascertained, the owner or occupier of the premises on which the nuisance arises, to appear before any two justices, in petty sessions assembled, at the usual place of meeting, who shall proceed to inquire into the said complaint; and if it be proved to their satis-

faction that the nuisance exists, or did exist at the time when the notice was given, or, if removed or discontinued since the notice was given, that it is likely to recur or to be repeated, the justices shall make an order in writing under their hands and seals on such person, owner, or occupier for the abatement or discontinuance and prohibition of the nuisance as herein-after mentioned, and shall also make an order for the payment of all calls incurred up to the time of hearing or making the order for abatement or discontinuance or prohibition of the nuisance.

Justices' order for abatement.—Prohibitive order against future Nuisance.

13. By their order the justices may require the person on whom it is made to provide sufficient privy accommodation, means of drainage, or ventilation, or to make safe and habitable, or to pave, cleanse, whitewash, disinfect, or purify the premises which are a nuisance or injurious to health, or such part thereof as the justices may direct in their order, or to drain, empty, cleanse, fill up, amend, or remove the injurious pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ashpit which is a nuisance or injurious to health, or to provide a substitute for that complained of, or to carry away the accumulation or deposit which is a nuisance or injurious to health, or to provide for the cleanly and wholesome keeping of the animal kept so as to be a nuisance or injurious to health, or if it be proved to the justices to be impossible so to provide, then to remove the animal, or any or all of these things (according to the nature of the nuisance), or to do such other works or acts as are necessary to abate the nuisance complained of, in such manner and within such time as in such order shall be specified; and if the justices are of opinion that such or the like nuisance is likely to recur, the justices may further prohibit the recurrence of it, and direct the works necessary to prevent such recurrence, as the case may in the judgment of such justices require; and if the nuisance proved to exist be such as to render a house or building, in the judgment of the justices, unfit for human habitation, they may prohibit the using thereof for that purpose until it is rendered fit for that purpose in the judgment of the justices, and on their being satisfied that it has been rendered fit for such purpose they may determine their previous order by another declaring such house habitable, from the date of which other order such house may be let or inhabited.

Penalty for contravention of order of abatement and prohibition.—Authority may enter and remove or abate Nuisance.

14. Any person not obeying the said order for abatement shall,

if he fail to satisfy the justices that he has used all due diligence to carry out such order, be liable for every such offence to a penalty of not more than 10*s.* per day during his default; and any person knowingly and wilfully acting contrary to the said order of prohibition, shall be liable for every such offence to a penalty not exceeding 20*s.* per day during such contrary action; and the local authority may, under the powers of entry given by this Act, enter the premises to which the order relates, and remove or abate the nuisance condemned or prohibited, and do whatever may be necessary in execution of such order, and charge the cost to the person on whom the order is made, as herein-after provided.

Appeal.

15. Any such order of prohibition may be appealed against as provided in this Act.

Appeal against order of abatement when structural works are required.

16. When it shall appear to the justices that the execution of structural works is required for the abatement of a nuisance, they may direct such works to be carried out under the direction or with the consent or approval of any public board, trustees, or commissioners having jurisdiction in the place in respect of such works; and if within seven days from the date of the order the person on whom it is made shall have given notice to the local authority of his intention to appeal against it as provided in this Act, and shall have entered into recognizances to try such appeal as provided be this Act, and shall appeal accordingly, no liability to penalty shall arise, nor shall any work be done nor proceedings taken under such order until after the determination of such appeal, unless such appeal cease to be prosecuted.

If person causing Nuisance cannot be found, Authority to execute order at once.

17. Whenever it appears to the satisfaction of the justices that the person by whose act or default the nuisance arises, or the owner or occupier of the premises is not known or cannot by found, then such order may be addressed to and executed by such local authority, and the cost defrayed out of the rates or funds applicable to the execution of this Act.

Manure, &c., to be sold.

18. Any matter or thing removed by the local authority in pursuance of this enactment, may be sold by public auction, after not less than five days' notice by posting bills distributed in the locality, unless in cases where the delay would be prejudicial to health,

when the justices may direct the immediate removal, destruction, or sale of the matter or thing; and the money arising from the sale retained by the local authority, and applied in payment of all expenses incurred under this Act with reference to such nuisance, and the surplus, if any, shall be paid, on demand, by the local authority, to the owner of such matter or thing.

Costs and expenses of works to be paid by person on whom order is made, or owner or occupier.

19. All reasonable costs and expenses from time to time incurred in making a complaint, or giving notice, or in obtaining an order of justices under this Act, or in carrying the same into effect under this Act, shall be deemed to be money paid for the use and at the request of the person on whom the order is made, or if the order be made on the local authority, or if no order be made, but the nuisance be proved to have existed when the complaint was made or the notice given, then of the person by whose act or default the nuisance was caused; and in case of nuisances caused by the act or default of the owner of premises, the said premises shall be and continue chargeable with such costs and expenses, and also with the amount of any penalties incurred under this Act, until the same be fully discharged, provided that such costs and expenses shall not exceed in the whole one year's rackrent of the premises; and such costs and expenses, and penalties, together with the charges of suing for the same, may be recovered in any county or superior court, or, if the local authority think fit, before any two justices of the peace; and the said justices shall have power to divide such costs, expenses, and penalties between the persons by whose act or default the nuisance arises, in such manner as they shall consider reasonable; and if it appear to them that a complaint made under this Act is frivolous or unfounded, they may order the payment by the local authority or person making the complaint of the costs incurred by the person against whom the complaint is made, or any part thereof.

Proceedings before Justices to recover expenses.

20. Where any costs, expenses, or penalties are due under or in consequence of any order of justices made in pursuance of this Act as aforesaid, any justice of the peace, upon the application of the local authority, shall issue a summons, requiring the person from whom they are due to appear before two justices at a time and place to be named therein; and upon proof to the satisfaction or the justices present that any such costs, expenses, or penalties are so due, such justices, unless they think fit to excuse the party summoned upon the ground of poverty or other special circum

stances, shall, by order in writing under their hands and seals, order him to pay the amount to the local authority at once, or by such instalments as the justices think fit, together with the charges attending such application and the proceedings thereon; and if the amount of such order, or any instalment thereof, be not paid within fourteen days after the sum is due, the same may, by warrant of the said or other justices, be levied by distress and sale.

Surveyors of highways to cleanse ditches, &c., paying owners, &c., for damages.

21. All surveyors and district surveyors may make, scour, cleanse, and keep open all ditches, gutters, drains, or watercourses in and through any lands or grounds adjoining or lying near to any highway, upon paying the owner or occupier of such lands or grounds, provided they are not waste or common, for the damages which he shall thereby sustain, to be settled and paid in such manner as the damages for getting materials in enclosed lands or grounds are directed to be settled and paid by the law in force for the time being with regard to highways.

Power to Authority to cover and improve open ditches, &c.

22. Whenever any ditch, gutter, drain, or watercourse used or partly used for the conveyance of any water, filth, sewage, or other matter from any house, buildings, or premises, is a nuisance within the meaning of this Act, and cannot, in the opinion of the local authority, be rendered innocuous without the laying down of a sewer or of some other structure, along the same or part thereof, or instead thereof, such local authority shall and they are hereby required to lay down such sewer or other structure, and to keep the same in good and serviceable repair; and they are hereby declared to have the same powers as to entering lands for the purposes thereof, and to be entitled to recover the same penalties in case of interference, as are contained in the 67th and 68th sections of the Act passed in the 5th and 6th years of the reign of King William IV., intituled "An Act for consolidating and amending the laws relating to highways in England;" and such local authority are hereby authorized and empowered to assess every house, building, or premises, then or at any time thereafter using for the purposes aforesaid the said ditch, gutter, drain, watercourse, sewer, or other structure, to such payment, either immediate or annual, or distributed over a term of years, as they shall think just and reasonable, and after fourteen days' notice at the least left on the premises so assessed, to levy and collect the sum and sums so assessed in the same manner, and with the same remedies in case of default in payment thereof, as highway rates are by the law in

force for the time being leviable and collectable, and with the same right and power of appeal against the amount of such assessments reserved to the person or persons so assessed as by the law for the time being in force shall be given against any rate made for the repair of the highways; and the provisions contained in this section shall be deemed to be part of the law relating to highways in England. Provided always, that where such ditch, gutter, drain, or watercourse shall, as to parts thereof, be within the jurisdiction of different local authorities, this enactment shall apply to each local authority only as to so much of the works hereby required, and the expenses thereof, as is included within the respective jurisdiction of that authority. Provided also, that such assessment shall in no case exceed a shilling in the pound on the assessment to the highway rate, if any.

Penalty for causing water to be corrupted by gas washings.

23. Any person or company engaged in the manufacture of gas who shall at any time cause or suffer to be brought or to flow into any stream, reservoir, or aqueduct, pond, or place for water, or into any drain communicating therewith, any washing or other substance produced in making or supplying gas, or shall wilfully do any act connected with the making or supplying of gas whereby the water in any such stream, reservoir, aqueduct, pond, or place for water shall be fouled, shall forfeit for every such offence the sum of £200.

Penalty to be sued for in Superior Courts within six months.

24. Such penalty may be recovered, with full costs of suit, in any of the superior courts, by the person into whose water such washing or other substance shall be conveyed or shall flow, or whose water shall be fouled by any such act as aforesaid, or if there be no such person, or in default of proceedings by such person, after notice to him from the local authority of their intention to proceed for such penalty, by the local authority; but such penalty shall not be recoverable unless it be sued for during the continuance of the offence, or within six months after it shall have ceased.

Daily penalty during the continuance as the offence.

25. In addition to the said penalty of £200 (and whether such penalty shall have been recovered or not), the person or company so offending shall forfeit the sum of £20 (to be recovered in the like manner) for each day during which such washing or other substance shall be brought or shall flow as aforesaid, or during which the act by which such water shall be fouled shall continue, after the expiration of twenty-four hours from the time when

notice of the offence shall have been served on such person or company by the local authority, or the person into whose water such washing or other substance shall be brought or flow, or whose water shall be fouled thereby, and such penalty shall be paid to the parties from whom such notice shall proceed; and all mon ys recovered by a local authority under this or the preceding section shall, after payment of any damage caused by the act for which the penalty is imposed, be applied towards defraying the expenses of executing this act.

[Sec. 26 repealed.]

As to nuisances arising in cases of noxious trades, businesses, processes, or manufactures.

27. If any candle house, melting house, melting place, or soap house, or any slaughter-house, or any building or place for boiling offal or blood, or for boiling, burning, or crushing bones, or any manufactory, building, or place used for any trade, business, process, or manufacture causing effluvia, be at any time certified to the local authority by any medical officer, or any two legally qualified medical practitioners, to be a nuisance or injurious to the health of the inhabitants of the neighbourhood, the local authority shall direct complaint to be made before any justice, who may summon before any two justices in petty sessions assembled at their usual place of meeting the person by or in whose behalf the work so complained of is carried on, and such justices shall inquire into such complaint, and if it shall appear to such justices that the trade or business carried on by the person complained against is a nuisance, or causes any effluvia injurious to the health of the inhabitants of the neighbourhood, and that such person shall not have used the best practicable means for abating such nuisance, or preventing or counteracting such effluvia, the person so offending (being the owner or occupier of the premises, or being a foreman or other person employed by such owner or occupier), shall, upon a summary conviction of such offence, forfeit and pay a sum of not more than £5, nor less than forty shillings, and upon a second conviction for such offence the sum of £10, and for each subsequent conviction a sum double the amount of the penalty imposed for the last preceding conviction, but the highest amount of such penalty shall not in any case exceed the sum of £200. Provided always, that the justices may suspend their final determination in any such case, upon condition that the person so complained against shall undertake to adopt, within a reasonable time, such means as the said justices shall judge to be practicable and order to be carried into effect for abating such nuisance, or mitigating, or preventing the injurious effects of such effluvia, or shall give notice of appeal

in the manner provided by this Act, and shall enter into recognizances to try such appeal, and shall appeal accordingly. Provided always, that the provisions herein-before contained shall not extend or be applicable to any place without the limits of any city, town, or populous district.

Reference to Superior Court at the option of the party complained against.

28. Provided also, that if, upon his appearance before such justices, the party complained against object to have the matter determined by such justices, and enter into recognizances, with sufficient sureties to be approved by the justices, to abide the event of any proceedings at law or in equity that may be had against him on account of the subject matter of complaint, the local authority shall thereupon abandon all proceedings before the justices, and shall forthwith take proceedings at law or in equity in her Majesty's superior courts for preventing or abating the nuisance complained of.

On certificate of Medical Officer to Authority that House is overcrowded, proceedings may be taken to abate the same.

29. Whenever the medical officer of health, if there be one, or, if none, whenever two qualified medical practitioners, shall certify to the local authority that any house is so overcrowded as to be dangerous or prejudicial to the health of the inhabitants, and the inhabitants shall consist of more than one family, the local authority shall cause proceedings to be taken before the justices to abate such overcrowding, and the justices shall thereupon make such order as they may think fit, and the person permitting such overcrowding shall forfeit a sum not exceeding forty shillings.

Authority to order costs of prosecutions to be paid out of the rates.

30. The local authority may, within the area of their jurisdiction, direct any proceedings to be taken at law or in equity in cases coming within the purview of this Act, and may order proceedings to be taken for the recovery of any penalties, and for the punishment of any persons offending against the provisions of this Act, or in relation to appeals under this Act, and may order the expenses of all such proceedings to be paid out of the rates or funds administered by them under this Act.

Part III.

With regard to Procedure under this Act.

Service of notices, summonses, and orders.

31. Notices, summonses, and orders under this Act may be

served by delivering the same to or at the residence of the persons to whom they are respectively addressed, and where addressed to the owner or occupier of premises they may also be served by delivering the same or a true copy thereof to some person upon the premises, or if there be no person upon the premises who can be so served, by fixing the same upon some conspicuous part of the premises, or if the person shall reside at a distance of more than five miles from the office of the inspector then by a registered letter through the post.

Proof of resolutions of Authority.

32. Copies of any orders or resolutions of the local authority or their committee, purporting to be signed by the chairman of such body or committee, shall, unless the contrary be shown, be received as evidence thereof, without proof of their meeting, or of the official character or signature of the person signing the same.

As to proceedings taken against several persons for the same offence.

33. Where proceedings under this Act are to be taken against several persons in respect of one nuisance caused by the joint act or default of such persons, it shall be lawful for the local authority to include such persons in one complaint, and for the justices to include such persons in one summons, and any order made in such a case may be made upon all or any number of the persons included in the summons, and the costs may be distributed as to the justices may appear fair and reasonable.

One or more joint owners or occupiers may be proceeded against alone.

34. In case of any demand or complaint under this Act to which two or more persons, being owners or occupiers of premises, or partly the one or partly the other, may be answerable jointly or in common or severally, it shall be sufficient to proceed against any one or more of them without proceeding against the others or other of them; but nothing herein contained shall prevent the parties so proceeded against from recovering contribution in any case in which they would now be entitled to contribution by law.

Designation of "Owner" or "Occupier."

35. Whenever in any proceeding under this Act, whether written or otherwise, it shall become necessary to mention or refer to the owner or occupier of any premises, it shall be sufficient to designate him as the "owner" or "occupier" of such premises without name or further description.

Penalty for obstructing execution of this Act.

36. Whoever refuses to obey an order of justices under this Act for admission on premises of the local authority or their officers, or wilfully obstructs any person acting under the authority or employed in the execution of this Act, shall be liable for every such offence to a penalty not exceeding £5.

Penalty on occupier obstructing owner.

37. If the occupier of any premises prevent the owner thereof from obeying or carrying into effect the provisions of this Act, any justice to whom application is made in this behalf shall by order in writing require such occupier to desist from such prevention, or to permit the execution of the works required to be executed, provided that such works appear to such justice to be necessary for the purpose of obeying or carrying into effect the provisions of this Act; and if within twenty-four hours after the service of such order the occupier against whom it is made do not comply therewith, he shall be liable to a penalty not exceeding £5 for every day afterwards during the continuance of such non-compliance.

Penalties and expenses recoverable under 11 *and* 12 *Vict.* c. 43.

38. Penalties imposed by this Act for offences committed and sums of money ordered to be paid under this Act may be recovered by persons thereto competent in England according to the provisions of the Act of the 11th and 12th years of the present reign, chapter 43; and all penalties recovered by the local authority under this Act shall be paid to them, to be by them applied in aid of their expenses under this Act.

Proceedings not to be quashed for want of form.

39. No order, nor any other proceeding, matter, or thing done or transacted in or relating to the execution of this Act, shall be vacated, quashed, or set aside for want of form, nor shall any order, nor any other proceeding, matter, or thing done or transacted in relation to the execution of this Act, be removed or removable by certiorari, or by any other writ or process whatsoever, into any of the superior courts; and proceedings under this Act against several persons included in one complaint shall not abate by reason of the death of any among the persons so included, but all such proceedings may be carried on as if the deceased person had not been originally so included.

Appeals under this Act to be to Quarter Sessions.

40. Appeals under this Act shall be to the court of Quarter Sessions held next after the making of the order appealed against;

but the appellant shall not be heard in support of the appeal unless within fourteen days after the making of the order appealed against he give to the local authority notice in writing stating his intention to bring such appeal, together with a statement in writing of the grounds of appeal, and shall within two days of giving such notice enter into a recognizance before some justice of the peace, with sufficient securities, conditioned to try such appeal at the said court, and to abide the order of and pay such costs as shall be awarded by the justices at such court or any adjournment thereof; and the said court, upon hearing and finally determining the matter of the appeal, may, according to its discretion, award such costs to the party appealing or appealed against as they shall think proper, and its determination in or concerning the premises shall be conclusive and binding on all persons to all intents or purposes whatsoever. Provided always, that if there be not time to give such notice and enter into such recognizance as aforesaid, then such appeal may be made to, and such notice, statement, and recognizance be given and entered into for, the next sessions at which the appeal can be heard; provided also, that on the hearing of the appeal no grounds of appeal shall be gone into or entertained other than those set forth in such statement as aforesaid; provided also, that in any case of appeal the court of Quarter Sessions may, if they think fit, state the facts specially for the determination of her Majesty's court of Queen's Bench, in which case it shall be lawful to remove the proceedings, by writ of certiorari or otherwise, into the said court of Queen's Bench.

Forms to be used as in Schedule.

41. The forms contained in the schedule to this Act annexed, or any forms to the like effect, varied as circumstances may require, may be used for instruments under this Act, and shall be sufficient for the purpose intended.

As to protection of authority and its officers.

42. The local authority, and any officer or person acting under the authority and in execution or intended execution of this Act, shall be entitled to such protection and privilege in actions and suits, and such exemption from personal liability, as are granted to local boards of health and their officers by the law in force for the time being.

Act not to impair Jurisdiction of Sewers Commissioners, or Common Law remedies for Nuisance, nor Jurisdiction of authority as to the Nuisances referred to in this Act.

43. Nothing in this Act shall be construed to affect the provisions of any local Act as to matters included in this Act, nor to

impair, abridge, or take away any power, jurisdiction, or authority which may at any time be vested in any commissioners of sewers or of drainage, or to take away or interfere with any course of proceedings which might be resorted to or adopted by such Commissioners if this Act had not passed, nor to impair any power of abating nuisances at common law, nor any jurisdiction in respect of nuisances that may be possessed by any authority under the Act intituled "An Act to abate the nuisances arising from the smoke of furnaces in the metropolis, and from steam vessels above London Bridge," or the Common Lodging Houses Acts, the Act for the Regulation of Municipal Corporations, the Public Health Act, or any improvement Act respectively, or any Acts incorporated with such Acts, and authorities may respectively proceed for the abatement of nuisances or in respect of any other matter or thing hereinbefore provided or referred to either under the Acts mentioned in this section or any other Act conferring jurisdiction in respect of the nuisances referred to in this Act, or any bye-laws framed under any such Act, as they may think fit; and the local authorities constituted under and for the purposes of the Common Lodging Houses Acts, 1851 and 1853, shall for the purposes of those Acts have all the powers of local authorities under this Act.

Act not to affect navigation of rivers or canals.

44. Nothing herein contained shall enable any local authority, surveyor of highways, or other person, either with or without any order of justices, to injuriously affect the navigation of any river or canal, or to divert or diminish any supply of water of right belonging to any such river or canal; and the provisions of this Act shall not extend or be construed to extend to mines of different descriptions so as to interfere with or obstruct the efficient working of the same, or to the smelting of ores and minerals, or to the manufacturing of the produce of such ores and minerals.

Saving as to rights of mill-owners, &c.

45. No power given by this Act shall be exercised in such manner as to injuriously affect the supply, quality, or fall of water contained in any reservoir or stream, or any feeders of such reservoir or stream, belonging to or supplying any waterwork established by Act of Parliament, or in cases where any company or individual are entitled for their own benefit to the use of such reservoir or stream, or to the supply of water contained in such feeders, without the consent in writing of the company or corporation in whom such waterworks may be vested, or of the parties so entitled to the use of such reservoirs, streams, and feeders, and also of the owners thereof in cases where the owners and parties so entitled are not the same person.

Short Title.

46. In citing this Act in other Acts of Parliament, and in legal instruments and other proceedings, it shall be sufficient to use the words "The Nuisances Removal Act for England, 1855."

SCHEDULE OF FORMS.

FORM (A.) *Order of Justices for Admission of Officer of Authority to inspect private Premises.*

WHEREAS [*describe the Authority*] have by their officer [naming him] made application to me *A. B.*, One of Her Majesty's Justices of the Peace having jurisdiction in and for [*describe the place*], and the said officer has made oath to me of his belief that a nuisance within the meaning of the Nuisances Removal Act for England, 1855, as amended and extended to Ireland by the sanitary act, 1866, viz. [*describe nuisances*], exist on private premises at [*describe situation of premises so as to identify them*], within my jurisdiction, and demand of admission to such premises for the inspection thereof has been duly made under the said Act, and refused:

Now, therefore, I, the said *A. B.*, do hereby require you to admit the said [*name the Authority*], [*or* the officer of the said *Authority*], for the purpose of inspecting the said premises.

Dated this day of 18 . *A. B.*

FORM (B.) *Notice of Nuisance.*

To the Authority (*describing it*).

I [*or* We], the person aggrieved by the nuisances hereinafter described [*or* the undersigned and described inhabitant householders, Sanitary Inspector, *or other officer (describing him)*], do hereby give you notice, that there exists in or upon the [dwelling house, yard, *etc., as he case may be*], situate at [*giving such description as may be sufficient to identify the premises*] in the parish of in your district, under the Nuisance Removal Act, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, the following nuisances, videlicet [*describing the nuisance, as the case may be; for instance*, a dwelling house or building a nuisance or injurious to health for want of a privy *or* drain *or* sufficient means of ventilation, *or*, so dilapidated *or* so filthy as to be a nuisance or injurious to health, *or for further instance* a ditch *or* drain so foul as to be a nuisance or injurious to health, *or* an Accumulation of a nuisance or injurious to health, *&c.*, *or* swine so kept as to be a nuisance or injurious to health]; and that such nuisance is caused by [*naming the person by whose act or default the nuisance is caused, or* by some person unknown].

Dated this day of in the year of our Lord 18 .

[*Signed by Complainant under Section* 10].

FORM [C.] *Notice to owner or occupier of entry for examination.*

To the owner [*or* occupier, *as the case may be*,] of [*describe the premises*] situate at [*insert a description sufficient to identify the premises*].

Take notice, that under the Nuisances Removal Act for England, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, the [*authority naming it*,] in whose district under the said act the above premises are situate, have received a notice from (*name complainant*), stating that in or upon the said premises (*insert the cause of nuisance as set forth in the notice*).

And further take notice, that after the expiration of twenty-four hours from the service of this notice the *Authority* will cause the said premises to be entered and examined under the provisions of the said act, and if the cause of Nuisance aforesaid be found still existing, or, though removed or discontinued, be likely to be repeated, a summons will be issued requiring your attendance to answer a complaint which will be made to the justices for enforcing the removal of the same, and prohibiting a repetition thereof, and for recovering the costs and penalties that may be incurred thereby.

Dated this day of in the year of our Lord 18 .

A. B.,

The officer appointed by the *authority* to take proceedings under the Nuisances Removal Act for England, 1855, (as amended and extended to Ireland by the Sanitary Act, 1866.)

FORM (D) *Summons.*

To the owner or occupier of *(describe premises)* situate at *(insert such a description as may be sufficient to identify the premises)*, or to *A. B.* of

County of (*or* Borough of &c. *or* District of or *as the case may be)* to wit. } You are required to appear before two of her Majesty's Justices of the Peace (*or* one of the Magistrates of the police courts of the Metropolis, or the stipendiary Magistrate) of the County *(or other Jurisdiction)* of at the petty sessions (*or* court) holden at on the day of next, at the hour of in the noon, to answer the complaint this day made to me by (*or* by on behalf of) *(naming the authority, as the case may be)*, that in or upon the premises above mentioned (*or* in or upon certain premises situate at No. in the street in the parish of *or such other description or reference as may be sufficient to identify the premises)*, in their district, under the Nuisances Removal Act for England, 1855. as amended and extended to Ireland by the Sanitary Act 1866, the following nuisance exists (*describing it, as the case may be*), and that the said nuisance is caused by the act or default of the occupier (*or* owner) of the said premises, *or* by you *A. B.* (*or in case the nuisance be discontinued, but likely to be repeated, say*, there existed recently, to wit, on or about the day of on the premises, the following nuisance (*describe the nuisance*) and that the said nuisance was caused (*&c.*), and although the same has since the said last-mentioned day been removed or discontinued there is reasonable ground to consider that the same or the like nuisance is likely to recur on the said premises].

Given under the hand of me, *J. P.*, esquire, one of her Majesty's Justices of the peace acting in and for the [*jurisdiction*] stated in the margin, *or* one of the Magistrates of the police courts of the metropolis or stipendiary Magistrate of day of in the Year of our Lord One thousand eight hundred and

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FORM (E.) *Order of Justices for Removal of Nuisances by Owner, &c.*

To the owner (*or* occupier) of (*describe premises*) situate (*give such description as may be sufficient to identify the premises,*(*or* to A.B. of *or* to (*giving name of the authority*), or to their servants or agents, and to all whom it may concern.

County of [*or* Borough, &c. of *or* District of *or as the case may be*]. } Whereas on the day of complaint was made before esquire, one of her Majesty's Justices of the peace acting in and for the county) *or other Jurisdiction*) stated in the margin, *or* before the undersigned, one of the Magistrates of the police courts of the metropolis, *or as the case may be*], by [*or* by on behalf of] [*the*

authority naming it, as the case may be], that in or upon certain premises situate at in the district under the Nuisances Removal Act for England 1855, as amended and extended to Ireland by the Sanitary Act, 1866, of the complainants abovenamed, the following nuisance then existed [*describe it*]; and that the saidnuisance was caused by the act or default of the owner [*or* occupier] of the said premises [or was caused by A.B.] [*If the nuisance have been removed, say*, the following nuisance existed on or about [*the day the nuisance was ascertained to exist,*] and that the said nuisance was caused. &c., and although the same is now removed the same or the like nuisance if likely to recur on the same premises.]

And whereas the owner [*or* occupier] within the meaning of the said nuisance Removal Act, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, [or the said A.B., hath this day appeared before us Justices, being two of Her Majesty's Justices in and for sitting in petty Sessions at their usual place of meeting [*or* before me, the said magistrate of the police courts of the metropolis, *or as the case may be*], to answer the matter of the said complaint [*or in case the party charged do not appear say*], and whereas it hath been this day proved to our [*or* my] satisfaction that a true copy of a summons requiring the owner [*or* occupier of the said premises [*or* the said A.B., to appear this day before us [*or* me] had been duly served according to the said Act:

Now upon proof here had before us [*or* me] that the nuisance so complained of doth exist on the said premises, and that the same is caused by the act or default of the owner [*or* occupier] of the said premises [*or* by the said *A.B.*], we [*or* I], in pursuance of the said Act, do order the said owner [*or* occupier, *or A.B.*] within [*specify the time*] from the service of this order or a true copy thereof according to the said Act [*here specify the works to be done, as for instance*, to cleanse, whitewash, purify, and disinfect the said dwelling house; *or, for further instance*, to construct a privy *or* drain, &c.; *or, for further instance*, to cleanse *or* to cover *or* to fill up the said cesspool, &c.], so that the same shall no longer be a nuisance or injurious to health as aforesaid.

[*And if it appear to the Justices that the nuisance is likely to recur on the premises, say*] and we [*or* I] being satisfied that, notwithstanding the said cause or causes of nuisances may be removed under this order, the same is or are likely to recur, do therefore prohibit the said owner [*or* occupier *or A.B.*] from [*here insert the matter of the prohibition, as, for instance*, from using the said house or building for human habitation until the same, in our judgment, is rendered fit for that purpose].

And if the above order for abatement be not complied with [*or* if the above order of prohibition be infringed], then we [*or* I] do authorize and require you the said [*authority, naming it*], from time to time to enter upon the said premises, and to do all such works, matters, and things as may be necessary for carrying this order into full execution according to the Act aforesaid.

[*In case the nuisance were removed before complaint, say*] Now upon proof here had before us that at or recently before the time of making the said complaint, to wit, on as aforesaid, the cause of nuisance complained of did exist on the said premises, but that the same hath since been removed, yet, notwithstanding such removal, we [*or* I] being satisfied that it is likely that the same or the like nuisance will recur on the said premises, do hereby prohibit [*order of prohibition*]; and if this order of prohibition be infringed, then we [*or* I] [*order on authority to do works*].

Given under the hands and seals of us, two of Her Majesty's Justices of the Peace in and for [*or* the hand and seal of me, one of the Magistrates of the police courts of the metropolis, *or as the case may be*], this day of in the year of our Lord one thousand eight hundred and

FORM [F.] *Order of Justices for Removal of Nuisance by Authority.*

To the Town Council, &c., *as the case may be.*

County, &c. } WHEREAS [*recite complaint of nuisance as in last Form.*]
to wit. }

And whereas it hath been now proved to our [*or* my] satisfaction that, such nuisance exists, but that no owner or occupier of the premises, or person causing the nuisance, is known or can be found [*as the case may be*]: Now we [*or* I], in pursuance of the said Act, do order the said [*authority, naming it,*] forthwith to [*here specify the works to be done*].

Given, &c.

FORM (G.) *Order to permit Execution of Works by Owners.*

County of } WHEREAS complaint hath been made to me, *E. F.*
[*or* Borough of | Esquire, one of Her Majesty's Justices of the
or Metropolitan Police } Peace in and for the County [*or* borough, &c.]
District, *or as the case* | of [*or* one of the magistrates
may be], to wit. } of the police courts of the metropolis, *or as the case may be*, *or* one of Her Majesty's Justices of the Peace, *as the case may be*, of the County of], by *A.B.* owner within the meaning of the Nuisances Removal Act for England, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, of certain premises, to wit., a dwelling house [*or* building, *or as the case may be*], situate at [*insert such a description of the premises as may be sufficient to identify them*], in the parish of in the said county [*or* borough, &c] that *C.D.*, the occupier of the said premises, doth prevent the said *A.B.* from obeying and carrying into effect the provisions of the said Act, in this, to wit., that he the said *C.D.* [*here describe the act of prevention generally according to the circumstances; for instance, thus,* doth refuse to quit the said house the same having by the order of justices been declared unfit for human habitation, *or* doth prevent the said *A.B.* from cleansing or whitewashing, *or* purifying the said dwelling house, *or* erecting a privy or drain, *or* breaking an aperture for ventilation, *or* cleansing a drain, ditch, gutter, watercourse, privy, urinal, cesspool, or ashpit which is a nuisance or injurious to health]: And whereas the said *C.D.* has been summoned to answer the said complaint, and has not shown sufficient cause against the same, and it appears to me that [*describe the act or works to be done*] is necessary for the purpose of enabling the said *A.B.* to obey and carry into effect the provisions of the said Act, I do hereby order that the said *C.D.* do permit the said *A.B.* [*describe the act or works to be done*] in the manner required by the said Act.

Given under my hand and seal this day of
in the year of our Lord, 18 *E. F.* [L S.]

FORM (H.) *Summons for Nonpayment of Costs, Expenses, or Penalties.* Sec. 20

To [*describe the person from whom the costs, expenses, and penalties are due*].

County of } You are required to appear before two of Her
[*or* borough of | Majesty's Justices of the Peace [*or* one of the
or district of | magistrates of the police courts of the metropolis,
to wit.] } *or* the stipendiary magistrates] of the county [*or other jurisdiction*] of at the petty sessions [*or* court] holden at on the day of next, at the hour of in the noon, to answer the complaint this day made to me by [*or* by on behalf of] [*naming the authority*], that the sum of pounds, being costs and expenses incurred by you under and in relation to a certain complaint touching [*describe the nuisance*], and an order of [*describe the person making the order*] duly made in pursuance of the

Nuisances Removal Act for England, 1855, as amended and extended to Ireland by the Sanitary Act, 1866, (*if penalties are due, add*, and also the sum of being the amount of penalties payable by you for disobedience of the said order), remains unpaid and due from you.

Given under the hand of me, *J. P.*, Esquire, one of Her Majesty's Justices of the Peace acting in and for the (*jurisdiction stated in the margin*) (or one of the Magistrates of the police courts of the metropolis, *or* stipendiary magistrate of) the day of in the year of our Lord 18

FORM (I.) *Order for Payment of Costs, Expenses, and Penalties.* Sec. 20.

To (*name the person on whom the order is made*).

County, &c. } WHEREAS complaint has been made before us (*or* me) for to wit. } that [*recite cause of complaint*]:

And whereas the said [*naming the person against whom the complaint is made*] has this day appeared before us, the said justices [*or* before me the said magistrate of the police courts of the metropolis, *or as the case may be*], to answer this matter of the said complaint: [*or, in case the party charged do not appear, say,*]

And whereas it has been this day satisfactorily proved to us [*or* me] that a true copy of the summons requiring the said [*naming person charged*] to appear before us [*or* me] this day hath been duly served according to the said Act: now, having heard the matter of the said complaint, we [*or* I] do adjudge the said [*naming the person charged*] to pay forthwith [*or* by instalments of payable respectively on or before the] to the said [*naming the person or authority to whom the costs adjudged are payable*], the sum of for costs in this behalf, and to [*naming the person or authority to whom the expenses are payable*], the sum of for expenses in this behalf, [*if penalties are due, add*, and the sum of for penalties incurred in relation to the premises,] together with the sum of being the charges attending the application for this order and proceedings thereon; and if the said several sums, amounting in the whole to [*or* if any one of the said instalments] be not paid within fourteen days after the same is due as aforesaid, we [*or* I] hereby order that the same be levied by distress and sale of the goods and chattels of the said and in default of sufficient distress in that behalf adjudge the said to be imprisoned in the common gaol [*or* house of correction, *as the case may be*], at in the said county [*or as the case may be*] for the space of such time, not exceeding three calendar months, as the justices may think fit, unless the said several sums [*or* sum], and all costs and charges of the said distress [and of the commitment and carrying of the said to the said house of correction *or* common gaol, *or as the case may be*,] shall be sooner paid.

Given under our [*or* my] hands, this day of in the year of our Lord, 18 at in the [county, *or as the case may be*,] aforesaid.

FORM [K.] *Warrant of Distress.* Sec. 20.

To the constable of and to all other peace officers in the said county [*or as the case may be*].

WHEREAS on last past complaint was made before the undersigned, two of Her Majesty's justices of the peace in and for the said county of [*or as the case may be*] [*or* a magistrate of the police courts of the metropolis *or* stipendiary magistrate, *as the case may be*] for that [&c., *as in the order*]; and thereupon having considered the matter of the said complaint, we [*or* I] adjudge the said [*set out from Form K the adjudication*

of payment, and the order for distress, and for imprisonment in default of distress]: And whereas the time in and by the said order appointed for the payment of the said several sums of and hath elapsed, but the said hath not paid the same or any part thereof within fourteen days after the date fixed by the order for such payment, but therein hath made default: these are therefore to command you in Her Majesty's name forthwith to make distress of the goods and chattels of the said *A.B.* and if within the space of days after the making of such distress the said last-mentioned sums, together with the reasonable charges of taking and keeping the said distress, shall not be paid, that then you do sell the said goods and chattels so by you distrained, and do pay the money arising from such sale over to the clerk of the justices of the peace for the division of in the said [county, *or as the case may be*], that he may pay and apply the same as by law directed, and may render the overplus, if any, on demand, to the said ; and if no such distress can be found, then that you certify the same unto me, to the end that such proceedings may be had therein as to the law doth appertain.

Given under our [*or* my] hands and seals, this day of in the year of our Lord, 18 at in the [county] aforesaid. *A.B.* *C.D.* *L. S.*

FORM [L.] *Return of Proceedings under Nuisances Removal Act*, 1855, *as amended and extended to Ireland by the Sanitary Act*, 1866, *by the* (name the authority at length).

From 25th March, 1855, *to 25th March*, 1856.

Date of Notice.	By whom given.	Nature of Nuisance.	Proceedings taken.	Remarks:—With any special Work done under the Acts without any Notice.
16 April.	The Inspector.	Foul Drainage from House.	Owner put down good Drain, on Summons, without Justices' order.	Several houses being in a like position, the highway Surveyor laid down a sewer in the old watercourse, and each house was charged a proportionate sum for the same, of which the highest sum was 10s.
18 April.	Two Neighbours.	Offensive Cesspool.	Abated by [Nuisance] Authority.	Renewed once: but penalty recovered, and no subsequent renewal attempted.

Dated this 26th day of March, 1856. [*To be signed by the chairman of the authority.*]

18 & 19 *Vic.*, *cap.* 116.—*An Act for the better Prevention of Diseases*, 1865.

WHEREAS the provisions of "The Nuisances Removal and Diseases Prevention Act, 1848," amended by "The Nuisances Removal and Diseases Prevention Amendment Act, 1849," in so far as the same relate to the prevention or mitigation of epidemic, endemic, or contagious diseases, are defective, and it is expedient to substitute other provisions more effectual in that behalf: Be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal

and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

Short Title.

1. This Act may be cited for all purposes as the "Diseases Prevention Act, 1855."

[Secs. 2 and 3 repealed].

Power of Entry.

4. The local authority and their officers shall have the power of entry for the purposes of this Act, and for executing or superintending the execution of the regulations and directions of the general board issued under this Act.

Power to Privy Council to issue orders that provision herein contained for prevention of diseases may be put in force.

5. Whenever any part of England appears to be threatened with or is affected by any formidable epidemic, endemic, or contagious disease, the Lords and others of her Majesty's most honourable Privy Council, or any three or more of them (the Lord President of the Council or one of her Majesty's principal Secretaries of State being one), may, by order or orders to be by them from time to time made, direct that the provisions herein contained for the prevention of diseases be put in force in England, or in such parts thereof as in such order or orders respectively may be expressed, and may from time to time, as to all or any of the parts to which any such order or orders extend, and in like manner, revoke or renew any such order; and, subject to revocation and renewal as aforesaid, every such order shall be in force for six calendar months, or for such shorter period as in such order shall be expressed; and every such order of her Majesty's Privy Council, or of any members thereof, as aforesaid, shall be certified under the hand of the clerk in ordinary of her Majesty's Privy Council, and shall be published in the *London Gazette;* and such publication shall be conclusive evidence of such order, to all intents and purposes.

Power to General Board of Health to issue regulations to carry out such provisions.—Local extent and duration of regulations of General Board.

6. From time to time after the issuing of any such order as aforesaid, and whilst the same continues in force, the General Board of Health may issue directions and regulations, as the said Board think fit: For the speedy interment of the dead: For house to house visitation: For the dispensing of medicines, guarding against the spread of disease, and affording to persons afflicted by

or threatened with such epidemic, endemic, or contagious diseases such medical aid and such accomodation as may be required. And from time to time, in like manner, may revoke, renew, and alter any such directions and regulations as to the said Board appears expedient, to extend to all parts in which the provisions of this Act for the prevention of disease shall for the time being be put in force under such orders as aforesaid, unless such directions and regulations be expressly confined to some of such parts, and then to such parts as therein are specified; and (subject to the power of revocation and alteration herein contained) such directions and regulations shall continue in force so long as the said provisions of this Act shall under such order be applicable to the same parts.

Publication of such regulations.

7. Every such direction and regulation as aforesaid, when issued, shall be published in the *London* (*Dublin*) *Gazette*, and the Gazette in which such direction or regulation was published shall be conclusive evidence of the direction or regulation so published, to all intents and purposes.

The Local Authority to see to the execution of such regulations, &c.

8. The local authority shall superintend and see to the execution of such directions and regulations, and shall appoint and pay such medical or other officers or persons, and do and provide all such acts, matters, and things, as may be necessary for mitigating such disease, or for superintending or aiding in the execution of such directions and regulations, or for executing the same, as the case may require.

And may direct prosecutions for violating the same.

9. The local authority may from time to time direct any prosecutions or legal proceedings for or in respect of the wilful violation or neglect of any such direction or regulation.

Orders of Council, Directions and regulations to be laid before Parliament.

10. Every order of her Majesty's Privy Council, and every direction and regulation of the General Board of Health, under this Act, shall be laid before both Houses of Parliament, forthwith upon the issuing thereof, if Parliament be then sitting, and if not then within fourteen days next after the commencement of the then next session of Parliament.

Order in Council may extend to parts and arms of the sea.

11. Orders in council issued in pursuance of this Act for putting

in force the provisions for the prevention of disease in the said Nuisances Removal and Diseases Prevention Acts contained, in Great Britain, may extend to parts and arms of the sea lying within the jurisdiction of the admiralty; and the Board of Health for England may issue under this act directions and regulations for cleansing, purifying, ventilating, and disinfecting, and providing medical aid and accommodation, and preventing disease in ships and vessels, as well upon arms and parts of the sea aforesaid as upon inland waters.

Medical Officer of Unions and others entitled to costs of attending sick on board vessels, when required by orders of General Board of Health.

12. Whenever, in compliance with any regulation of the General Board of Health, which they may be empowered to make under this Act, any medical officer appointed under and by virtue of the laws for the time being for the relief of the poor shall perform any medical service on board of any vessel, such medical officer shall be entitled to charge extra for any such service, at the general rate of his allowance for his services for the union or place for which he is appointed, and such charges shall be payable by the captain of the vessel, on behalf of the owners, together with any reasonable expenses for the treatment of the sick; and if such services shall be rendered by any medical practitioner who is not a union or parish officer, he shall be entitled to charges for any service rendered on board, with extra remuneration on account of distance, at the same rate as those which he is in the habit of receiving from private patients of the class of those attended and treated on shipboard, to be paid as aforesaid; and in case of dispute in respect of such charges, such dispute may, where the charges do not exceed £20, be determined summarily, at the place where the dispute arises, as in case of seamen's wages, not exceeding £50, according to the provisions of the law in that behalf for the time being in force; and any justice before whom complaint is made shall determine summarily as to the amount which is reasonable according to the accustomed rate of charge within the place for attendance on patients of the like class or condition as those in respect of whom the charge is made.

Authentication of Directions and Regulations of General Board of Health.

13. The directions and regulations of the General Board of Health under this enactment shall be under the seal of the said Board, and the hand of the president or two or more members thereof; and any copy of such regulations purporting to bear such

seal and signature, whether the said signature and seal be respectively impressed and written, or printed only, shall be evidence in all proceedings in which such regulations may come in question.

Penalty for obstructing execution of Act.

14. Whoever wilfully obstructs any person acting under the authority or employed in the execution of this Act, and whosoever wilfully violates any direction or regulation issued by the General Board of Health, as aforesaid, shall be liable for every such offence to a penalty not exceeding £5, to be appropriated in or towards the defraying the expenses of executing this Act.

Certain provisions of Nuisances Removal Act to apply to this Act.

15. The provisions of any general Act in force for the removal of nuisances, with regard to the service of notices, the proof of orders or resolutions of the local authority, and the recovery of penalties, shall extend and apply to this Act.

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23 & 24 *Vic., cap.* 77.—*An Act to amend the Acts for the Removal of Nuisances and the Prevention of Diseases*, 1860.

Whereas the provisions of "The Nuisances Removal Act for England, 1855," and "The Diseases Prevention Act, 1855," concerning the local authority for the execution of the said Acts are defective, and it is expedient that the said Acts should be amended as herein-after mentioned: Be it enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same as follows:

Sections 3, 6, 7, *and* 9 *of* 18 & 19 *Vict., cap.* 121 *repealed.—Nuisances Removal.*

1. Sections 3, 6, 7, and 9 of the said "Nuisances Removal Act for England, 1855," shall be repealed: Provided always that such repeal as aforesaid shall not extend to any charges or expenses already incurred, but the same may be defrayed and recovered, and all proceedings commenced or taken under the said Act, and not yet completed, may be proceeded with, and all contracts under the said Act shall continue and be as effectual, as if this Act had not been passed.

[Sec. 2, 3, and 4 applicable to England].

Board of Guardians may appoint Committees for particular parishes.

5. Provided that the board of guardians for a union may appoint a committee or committees of their own body, under section 5 of the said Nuisances Removal Acts, to act in and for one or more of the parishes or places for which the Board is the local authority; and every committee so appointed shall have the full power of executing the said Act in all respects, within the specified place or places for which it is appointed, unless its power be expressly limited by the term of its appointment; and the board of guardians shall cause the charges and expenses of every such committee to be paid out of the poor rates of the place or places for which such committee is appointed; and where a committee is so appointed for any such place or places the charges and expenses of the Board as local authority for or in respect of the place or places for which a committee is not appointed shall be paid or contributed by such last-mentioned place or places in like manner as the expenses of a committee: Provided that where any one such committee is appointed for all the places for which the Board is the local authority its charges and expenses shall be contributed and paid in like manner as the charges and expenses of the Board would have been contributed and paid if such committee had not been appointed.

[Sec. 6 applicable to England].

Wells, &c., belonging to any place vested in Local Authority, &c.

7. All wells fountains, and pumps provided under section 50 of "The Public Health Act, 1848," or otherwise, for the use of the inhabitants of any place, and not being the property of or vested in any person or Corporation other than officers of such place, shall be vested in the local authority under this Act for such place, who shall from time to time cause to be kept in good repair and condition and free from pollution all wells, fountains, and pumps vested in them under this Act, and may also keep in good repair and condition and free from pollution other wells, fountains, and pumps, dedicated to or open to the use of the inhabitants of such place.

Penalty for fouling water.

8. If any person do any act whatsoever whereby any fountain or pump is wilfully or maliciously damaged, or the water of any well, fountain, or pump is polluted or fouled, he shall, upon summary conviction of such offence before two justices, forfeit a sum not exceeding £5 for such offence, and a further sum not exceeding 20*s.* for every day during which such offence is continued after written notice from the local authority in relation thereto; but

nothing herein contained shall extend to any offence provided against by section 23 of the said "Nuisances Removal Act."

Appointment of Inspectors of Nuisances.

9. Local authorities under this Act may, for the purposes of the Act, severally appoint or employ inspectors of nuisances, and make such payments as they see fit for the remuneration and expenses of such inspectors.

Secs. 2 & 3 of 18 & 19 Vict., cap. 116, repealed.—Diseases Prevention.

10. Sections 2 and 3 of "The Diseases Prevention Act, 1855," and every other enactment constituting a local authority for the execution of the same Act, or providing for the expenses of the execution thereof, except those contained in the 18th and 19th of Victoria, cap. 120, the Metropolis Local Management Act, shall be repealed.

Guardians and overseers of the poor to be the Local Authorities for executing Diseases Prevention Act.

11. The board of guardians for every union or parish not within an union, in England shall be the local authority for executing the said Diseases Prevention Act in every place within their respective unions and parishes, and in every parish and place in England not within a union, and for which there is no board of guardians, the overseers of the poor shall be the local authority to execute the same Act; and the expenses incurred in the execution of such Act by the board of guardians for a union shall be defrayed out of the common fund thereof, and the expenses of the board of guardians or overseers of the poor of any single parish or place shall be defrayed out of the rates for the relief of the poor of such parish or place; provided that every such board of guardians shall, for the execution of the said Act for the prevention of diseases, have the like powers of appointing committees, with the like authority, and where any such committee is appointed the expenses thereof and of the Board shall be paid in the same manner, as herein-before provided where such a Board is the local authority for the execution of the said Nuisances Removal Act; provided also, that any expenses already incurred by any local authority in the execution of the said Act shall be defrayed as if this Act had not been passed; provided, moreover, that in respect of any place where, under this Act, the local authority for executing the Nuisances Removal Act is any other body than the board of guardians or the overseers of the poor, the Privy Council, if it see fit, may, in the manner provided for the exercise of its powers under the Public Health Act, 1858,

authorize such other body to be, instead of the board of guardians or the overseers of the poor, the local authority for executing the Diseases Prevention Act; provided also, that as regards the Metropolis the Vestries and District Boards under the Act of the session holden in the 18th and 19th years of her Majesty, cap. 120, within their respective parishes and districts, shall continue to be the local authorities for the execution of the said "Diseases Prevention Act, 1855," and their charges and expenses shall be defrayed as if this Act had not been passed.

Local Authorities may provide carriages for conveyance of infected persons.

12. It shall be lawful for the local authority for executing the said "Diseases Prevention Act," to provide and maintain a carriage or carriages suitable for the conveyance of persons suffering under any contagious or infectious disease, and to convey such sick and diseased persons as may be residing within such locality to any hospital or other place of destination, and the expense thereof shall be deemed to be an expense incurred in executing the said Act.

Justices, on the application of householders, may order the removal of nuisances.

13. Upon complaint before a Justice of the Peace by any inhabitant of any parish or place of the existence of any nuisance on any private premises in the same parish or place, such justice shall issue a summons requiring the person by whose act, default, permission, or sufferance the nuisance arises, or if such person cannot be found or ascertained, the owner or occupier of the premises on which the nuisance arises, to appear before two justices in petty sessions assembled at their usual place of meeting, who shall proceed to inquire into the said complaint, and act in relation thereto as in cases where complaint is made by a local authority under section 12 of the said Nuisances Removal Act, and as if the person making the complaint were such local authority; provided always, that it shall be lawful for the said justices, if they see fit, to adjourn the hearing or further hearing of such summons for an examination of the premises where the nuisance is alleged to exist, and to require the admission or authorize the entry into such premises of any constable or other person or persons, and thereupon the person or persons authorized by the order of the justices may enter and act as the local authority might under a like order made by any justice under section 11 of the said Act: provided also, that the costs in the case of every such application shall be in the discretion of the justices, and payment thereof may be ordered and enforced as in other cases of summary adjudication by justices:

Any order made by justices under this enactment shall be attended with the like penalties and consequences for disobedience thereof and subject to the like appeal as any order made under section 12 of the said Nuisances Removal Act, and the justices making such order may thereby authorize any constable or other person or persons to do all acts for removing or abating the nuisance condemned or prohibited, and for executing such order, in like manner as a local authority obtaining the like order might do under the said Act, and to charge the costs to the person on whom the order is made, as is provided in the case where a like order is obtained and executed by such local authority.

Guardians may procure sanitary reports and pay for the same.

14. The guardians of any union, or parish not within an union, may at any time employ one of their medical officers to make inquiry and report upon the sanitary state of their union or parish, or any part thereof, and pay a reasonable compensation for the same out of their common fund.

Interpretation of terms.

15. The several words used in this Act shall be construed in the same manner as is declared with reference to the same words in the above-cited Act, termed "The Nuisances Removal Act for England, 1855," and all the provisions therein, and in "The Diseases Prevention Act, 1855," contained, shall respectively be applicable to this Act, except so far as they shall be hereby repealed, or be inconsistent with anything herein provided.

Justices not incapable of acting by being members of bodies to execute Nuisances Removal Act.

16. No Justice of the Peace shall, unless objected to at the hearing of any complaint or charge, be deemed incapable of acting in cases other than appeals arising under the said Nuisances Removal Act by reason of his being a member of any body hereby declared to be the local authority to execute the said Act, or by reason of his being a contributor, or liable to contribute, to any rate or fund out of which it is hereby provided that all charges and expenses incurred in executing the said Act, and not recovered as therein provided, shall be defrayed.

In 1863 an Amendment Act was passed which repeals the 26th section of the Nuisances Act, 1855, and provides that the Medical Officer of Health or Inspector of Nuisances, may inspect any animal or matter intended for food, and if unfit it may be seized and carried before a Justice who may order its destruction and fine or imprison the owner.

26 & 27 *Vic., cap.* 117.—*An Act to amend the Nuisances Removal Act for England*, 1855, *with respect to the seizure of diseased and unwholesome meat*, 1863.

WHEREAS the provisions of "The Nuisances Removal Act for England, 1855," with regard to the inspection and seizure of diseased and unwholesome meat, are defective; and it is therefore expedient that the same should be repealed, and that other and more effectual provisions in that behalf should be substituted therefor: Be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

Sec. 26 *of recited Act repealed.*

1. From and after the passing of this Act the 26th section of the said Act is repealed.

Power to Medical Officer of Health or Inspector of Nuisances to inspect any animal, &c.

2. The Medical Officer of Health or Inspector of Nuisances may at all reasonable times inspect and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour exposed for sale, or deposited in any place for the purpose of sale or of preparation for sale, and intended for the food of man, the proof that the same was not exposed or deposited for such purpose or purposes, or was not intended for the food of man, resting with the party charged; and in case any such animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour appear to him to be diseased, or unsound, or unwholesome, or unfit for the food of man, it shall be lawful for such Medical Officer of Health or Inspector of Nuisances to seize, take, and carry away the same, or direct the same to be seized, taken, and carried away by any officer, servant, or assistant, in order to have the same dealt with by a Justice; and if it shall appear to the Justice that any such animal, or any of the said articles, is diseased, or unsound or unwholesome, or unfit for the food of man, he shall order the same to be destroyed, or so disposed of as to prevent such animal or articles from being exposed for sale or used for such food; and the person to whom such animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour belongs or did belong at the time of sale or of exposure for sale, or in whose possession or on whose premises the same is found, shall, upon conviction, be liable to a penalty not exceeding £20 for every

animal, carcase, or fish, or piece of meat, flesh, or fish, or any poultry, or game, or for the parcel of fruit, vegetables, corn, bread, or flour so found, or, at the discretion of the Justice, without the infliction of a fine, to imprisonment in the common gaol or house of correction for a term of not more than three calendar months.

Penalty for obstructing Medical Officer of Health, &c.

3. In case any person shall in any manner prevent such Medical Officer of Health or Inspector of Nuisances from entering any slaughter-house, shop, building, market, or other place where such animal, carcase, meat, poultry, or fish is kept for the purpose of sale or of preparation for sale, or shall in any manner obstruct or impede him, or his servant or assistant, when duly engaged in carrying the provisions of this Act into execution, such person shall be liable to a penalty not exceeding £5.

This and recited Act to be as one Act.

4. This Act and "The Nuisances Removal Act for England, 1855," shall be read and construed together as one Act.

Short Title.

5. This Act may be cited for all purposes as "The Nuisances Removal Act for England (Amendment) Act, 1863."

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28 & 29 *Vic., cap.* 75.—*An Act for facilitating the more useful application of Sewage in Great Britain and Ireland*, 1865.

WHEREAS it is expedient to remove difficulties under which local boards and other bodies having the care of sewers labour in disposing of the sewage of their districts so as not to be a nuisance, and to give facility to such authorities to make arrangements for the application of such sewage to land for agricultural purposes, be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same:

1. This Act, for all purposes, may be cited as "The Sewage Utilization Act, 1855."

Application of Act.

2. This Act shall not extend to any part of the metropolis as defined by the Act of the session 18th and 19th years of the pre-

sent reign, chapter 120, for better local management of the metropolis, and shall not, with the exception of clause 15, extend to any parish as defined in the schedule to this Act in a part of which parish the Public Health Act, 1848, and the Local Government Act, 1858, or one of such Acts, is in force at the time of the passing of this Act.

Definition of Sewer Authority.

3. The expression "sewer authority" shall, in the several places in the schedule annexed hereto in that behalf mentioned, mean the persons or bodies of persons referred to in the first column of the schedule annexed hereto; and the term "district," in relation to a sewer authority, shall, as respects each authority, mean the place in that behalf referred to in the second column of the said schedule. "Local Board" shall mean a local board authorized in pursuance of the "Public Health Act, 1838," and the "Local Government Act, 1858," or one of such Acts.

Power of Sewer Authorities.

4. Sewer authorities shall have power to construct such sewers as they may think necessary for keeping their district properly cleansed and drained, and shall, as respects all sewers constructed by them or under their control, whether the same were made before or after the passing of this Act, have all the powers that local boards have, in respect of sewers vested in or constructed by them, under the 45th and 46th sections of "The Public Health Act, 1848," the 30th section of "The Local Government Act, 1858," and the 4th section of "The Local Government Act, 1858, Amendment Act, 1861," subject to the provisions of the 5th and 6th sections of the last-mentioned Act, and to the saving clauses in "The Local Government Act, 1858," mentioned from 68 to 74, both inclusive; and in Scotland, in addition to such of the aforepowers as are applicable to Scotland, all the powers contained in section 7 (public sewers) of part four of "The General Police and Improvement (Scotland) Act, 1862."

Power of entry.

5. The sewer authority shall have the powers of entry conferred by the 143rd section of the "Public Health Act, 1848," for the purposes of making or keeping in repair any works made or to be made by them, as well as for the purposes specified in the said section.

Payment of expenses.

6. A sewer authority shall pay all expenses incurred by them in carrying this Act into effect out of the fund or rate in the schedule

in that behalf mentioned, and shall have all such powers of borrowing money on the security of such fund or rate as local boards have of borrowing money under "The Local Government Act, 1858," the Acts amending that Act, on the security of the funds or rates in the said Acts in that behalf mentioned, subject to the conditions and sanction under which such powers are exercised by local boards under the said Acts.

Power to take lands.

7. A sewer authority shall, for the purposes of this Act, have the powers of taking lands conferred on local boards by the 75th section of "The Local Government Act, 1858," and any Act amending the same.

Compensation.

8. Full compensation shall be made, out of any fund or rate applicable to the purposes of this Act, to all persons sustaining any damage by reason of the exercise of any of the powers of this Act; and in case of dispute as to amount, the same shall be settled by arbitration, as provided in "The Public Health Act, 1848," or any Act amending the same, or if the compensation claimed do not exceed the sum of £20, the same may be ascertained by and recovered before justices in a summary manner, in manner provided by the Acts mentioned in this section.

Power of Sewer Authorities to combine.

9. Two or more sewer authorities, including under that expression for the purposes of this section local boards, may combine together for the purpose of executing and maintaining any works that may be for the benefit of their respective districts, and all monies they may agree to contribute for the execution and maintenance of such common works shall, in the case of each authority be deemed to be expenses incurred by them in the execution of works within their district, and shall be raised accordingly.

Sewer Authority may take proceedings to prevent pollution of streams.

10. A sewer authority, with the sanction of her Majesty's Attorney General in England, and of the Attorney General for Ireland in Ireland, and of the Lord Advocate in Scotland, may, either in its own name or in the name of any other person, with the consent of such person, take such proceedings by indictment, bill in Chancery, action or otherwise, as it may deem advisable, for the purpose of protecting any watercourse within its jurisdiction from pollutions arising from sewage either within or without its district; and the costs of and incidental to any such proceedings, including any

costs that may be awarded to the defendant, shall be deemed to be expenses properly incurred by the sewer authority in carrying into effect the purposes of this act.

Sewers not allowed to drain into any stream, &c.

11. Nothing contained in this Act, or in the Acts referred to therein, shall authorize any sewer authority to make a sewer so as to drain direct into any stream or watercourse.

Power to Public Works Loan Commissioners to lend money to Sewer Authorities.

12. The Public Works Loan Commissioners, as defined by "The Public Works Loan Act, 1853," may advance to any sewer authority upon the security of any rate applicable to the purposes of this Act, without any further security, such sums of money as may be recommended by one of her Majesty's Principal Secretaries of State, to be applied by such authority in carrying into effect the purposes of this Act.

Powers of Act cumulative.

13. All powers given by this Act shall be deemed to be in addition to and not in derogation of any other powers conferred on any sewer authority by Act of Parliament, law, or custom; and the sewer authority may exercise such other powers in the same manas if this Act had not passed.

Sewer Authority may enter into contract for supply of sewage.

14. The sewer authority of any place may from time to time for the purpose of utilizing its sewage, agree with any person or body of persons, corporate or unincorporate, as to the supply of such sewage, and works to be made for the purpose of that supply, and the parties to execute the same and to bear the costs thereof, and the sums of money, if any, to be paid for that supply; provided that no contract shall be made for the supply of sewage for a period exceeding twenty-five years.

Application of 27 & 28 Vic., cap. 114, to works, &c., for supply of sewage.

15. The making of works of distribution and service for the supply of sewage to lands for agricultural purposes shall be deemed an "improvement of land" authorized by the "Land Improvement Act, 1864," and the provisions of that Act shall apply accordingly.

Board of Works in Ireland to have power of Secretary of State in sewage matters.

16. The commisioners of public works in Ireland shall, in re-

spect to any sewage authority or sewage matter in Ireland, have and exercise all the powers conferred by this Act or any Act incorporated herewith, on one of her Majesty's principal Secretaries of State; and all applications by this Act or any Act incorporated herewith, authorized or directed to be made to one of her Majesty's principal Secretaries of State in respect to sewage matters, or the powers conferred by this Act on sewage authorities, shall in Ireland be made to the commissioners of public works; and all orders made on such applications by said commissioners shall have the same force and effect as orders made by one of her Majesty's principal Secretaries of State on similar applications in England and Scotland.

The following clauses of the Public Health Act, 1848, have been extended to Ireland. 67. Cellars newly built not to be let as dwelling-rooms. No cellars to be let except under certain conditions (of size, airing, lighting, draining, &c.). 75. Local Board to provide sufficient supplies of water, and may erect waterworks, &c., unless any waterworks company within their district be able and willing to supply water upon terms. 76. Local Board may require that houses be supplied with water, &c., in certain cases. 77. May supply water for public baths, or trading, or manufacturing purposes. 78. May maintain and construct public cisterns for gratuitous use. 79. Penalty for injuring waterworks, diverting streams, or wasting water. 80. Penalties on persons for causing water in reservoirs to be fouled. 90. Private Improvement rates. 91. Proportion of which any be deducted from rent. 92. Redemption of special district and Private Improvement rates. 123. Mode of referring to arbitration. 124. Death, &c., of one of several arbitrators. 125. Appointment of umpire by the parties, or by Quarter Sessions. 126. Time within which award must be made. 127. Power to arbitrator to require production of documents—costs of reference—submission may be made a rule of court. 128. Declaration to be made by arbitrator and umpire.

The following clauses of the Local Government Act, 1858, have been extended to Ireland. 51. Clauses as to water supply of Public Health Act, extended. 52. Power of carrying water mains. 53. Power to directors of waterworks or market company to sell works, &c., to Local Boards. And the 20th clause of the Amendment Act, 1861, relating to the provision of water, is also extended to Ireland.

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